EPIDEMIC PNEUMONIA AT SCOTTER

AND NEIGHBOURHOOD:

ITS HISTORY, CAUSES, AND FUTURE PREVENTION.

BY

T. B. FRANKLIN EMINSON,

MEDICAL OFFICER OF THE SCOTTER DISTRICT OF THE GAINSBOROUGH UNION.

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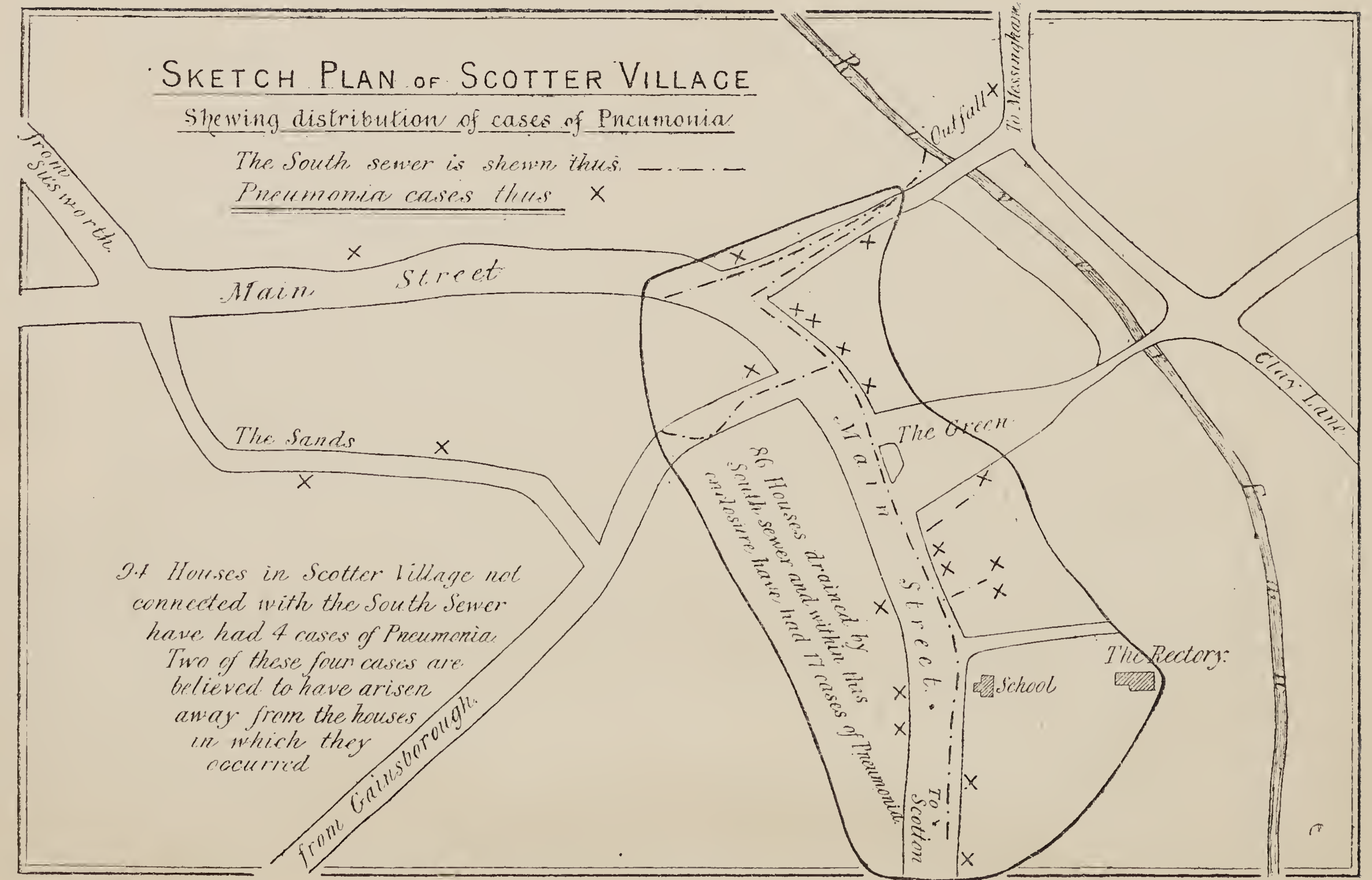

SKETCH PLAN OF SCOTTER VILLAGE

Shewing distribution of cases of Pneumonia

The South sewer is shewn thus. —·—·—

Pneumonia cases thus ×

86 Houses drained by South sewer and within this enclosure have had 17 cases of Pneumonia.

94 Houses in Scotter Village not connected with the South Sewer have had 4 cases of Pneumonia. Two of these four cases are believed to have arisen away from the houses in which they occurred.

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PREFACE.

The following account of these important outbreaks is intended for the information of the inhabitants of the district in which they occurred, and is couched in language as free as possible from technical phrases.

Nothing but good can accrue from a narration of the facts with which I am familiar, and a statement of the conclusions which, I think, those facts sufficiently warrant; indeed, it is highly necessary that those most concerned should be as fully informed as possible on all matters connected with the causation and prevention of the disease—a disease which, during the last eighteen months, has invaded more than a sixth of the houses of this village; and has attacked one in every twenty-one, and killed one in every forty-one of its inhabitants.

The history extends from April, 1890, to the present time, and includes four distinct outbreaks. The first, of appalling fatality, began on April 6th, and ended in Scotter on June 21st, 1890; the second occurred early in March, 1891; the third accompanied the epidemic of influenza in the present year, and was equally fatal with the first; and the fourth, in children, like the second, has been of recent occurrence and without fatality.

The first epidemic was investigated in July, 1890, by Dr. Parsons, of the Local Government Board; and he attributed it to sewer air emanations and simple contagion conjointly. The three epidemics of the present year will be found to bring strong additional light to both these points.

T. B. F. E.

Scotter,
October 5th, 1891.

EXPLANATIONS OF SKETCH PLAN OF SCOTTER.

The plan is not to scale, but simply a sketch. It shows the distribution of the pneumonia cases occurring in Scotter village, in the year ending March 31st, 1891; that is, the sixteen cases of the fatal epidemic of 1890, and the five cases occurring in March, 1891.

The village contains 180 houses; these are divided into two groups: the first group of eighty-six houses is enclosed by a thick black line, and includes all houses draining into or standing near the south sewer or its branches. These houses had seventeen cases of pneumonia in the year indicated: of which twelve occurred during the fatal epidemic of 1890, and five in March, 1891.

The latter cases on the plan are:—(*a*) the single case in the Gainsborough Road; (*b*) the two cases in the Messingham Road; and (*c*) two cases south of the school, and nearly opposite each other. All the rest are 1890 cases.

The second group includes all other houses in the village, ninety-four in number, outlying houses not being counted. They are sewered as described under "Drainage of Scotter." These houses have had four cases of pneumonia in them in the year ending March 31st; but two are believed to have originated away from the houses in which they occurred, viz.:—Fieldston's, at his old house on the south-east side of the Green, and my father's during his professional rounds. Neither Fieldston's, nor my father's house had any sewer.

The two remaining cases occurred at houses where untrapped and grossly insanitary sewers existed within a few feet of the doors. At one of them there was, many months after the mother's death from pneumonia, an outburst of diarrhœa amongst all the children, one of them dying; the other house has been pulled down, being unfit for habitation.

EPIDEMIC PNEUMONIA AT SCOTTER AND NEIGHBOURHOOD.

SCOTTER PARISH AND VILLAGE.

The parish contains the village of Scotter, a little south-east of its centre, and the hamlets of Scawthorpe and Susworth. Scawthorpe (usually called Scotterthorpe), is a mile north-west of Scotter, and Susworth, on the Trent bank, is three miles due west. Like the neighbouring parishes north and south, it is oblong in form, running five miles east and west, but only two miles north and south. Its narrow eastern extremity borders on the small parishes of Cleatham and Manton, at the foot of the Cliff hills, and its almost equally narrow western extremity lies on the river Trent. On the north, the parish of Messingham is conterminous with it, and to the south is Scotton parish, with its large and interesting old common. Scotton Common is of some importance in this connection, for it lies fully fifty feet above Scotter, and thus assists in producing the abundant water supply of the village; but it is specially interesting as the home of many rare plants and birds, and I cannot help here recording my regret that, instead of being preserved to instruct and delight future generations, it is about to be turned into indifferent arable land.

The village of Scotter (population 700), occupies a sheltered corner on the eastern border of the wide valley of the Trent, just where a low branch of the Cliff hills, approaching from the north, sweeps in a semicircle around the east to the south and south-west sides of the village, and then spreads out into the higher parts of Scotton Common. Scotter is thus more or less surrounded by high ground, except on the north and west where it is open to the valley. The middle of this semicircle is cut through by the little river Eau, which then runs through the north-eastern outskirts of the village and ultimately turns westward to its outfall into the Trent. The houses are mainly collected into one long street, with three side roads going out respectively to Gainsborough, Kirton and Messingham; and there is a back lane, "The Sands," running parallel with the western portion of the street. The situation of the village is low, though it varies considerably. In the Messingham road, near the west side of the river, the ground is only nineteen feet above the level of the sea, and where this road joins the main street it is only twenty-five feet altitude, which is about the average elevation of all the low-lying western portion of Scotter; but southwards the main street rises steadily to thirty, thirty-nine, forty-three, and fifty-two feet, the southern end running up the high ground already mentioned. Messingham, which, two miles farther north, sits on the summit of the same branch of the Cliff, is much higher, the centre of its main street being 107 feet; Little London, 111 feet; and the high road, opposite the church, 117 feet above the sea level.

The houses in Scotter village number about 180; they are mostly built of common brick, often of such porous nature that rain readily permeates the nine-inch walls, making the bed-rooms damp and the wall papers dank and mildewed. Most of them have been built without under-draining, and the foundations laid without slate or other damp-proof course, and, as the foundations in the lower parts of the village are often beneath the level of the subsoil water, the walls are excessively damp, moisture rising in some instances nearly as high as the bedrooms. Nearly forty per cent. are without spouting, and the rain-water, dropping close to the foundations, hollows out the ground, and lies in pools, making the walls and ground floors damper than they would otherwise be. Where spouting does exist, it is frequently rotten and grass-grown, the water running down the walls and into the cracks and crevices.

Rain-water cisterns are exceptional, forty-gallon paraffin casks being mostly used for storing soft water, without provision for the overflow which saturates the ground and adjacent walls. The oldest houses are built of local stone, and the walls being thick, the bedrooms are not so excessively damp, but the ground floors of these and some others are beneath the street level.

Overcrowding is not so common as in some neighbouring villages, but I have observed one or two gross instances, the most glaring being at a house where I felt sure a child died as a result of this.

DISEASE HISTORY OF SCOTTER.

The following information is derived from various sources: my father at the time he fell a victim to pneumonia had practised in Scotter for fifty-five years, and his father practised fifty years; it is therefore largely drawn from their experience, and from traditions which they have preserved. It has been supposed that Scotter was visited by the terrible Black Death, which swept like a flood over nearly the whole of Europe in the fourteenth century. The eastern counties of England suffered severely in the first recorded epidemic; and the existence of many skeletons in the gravelly soil on the east side of the Green, is pointed out as possibly the sole remaining evidence of its visit to Scotter. It may well be that Scotter suffered from this and other devastating visitations, and the fact that no records to this effect have yet been met with has little weight against such a supposition, for the burial records of Scotter and neighbouring villages date no further back than the sixteenth century, and it is only from these and similar sources that any reliable information can be obtained; yet for many reasons it is very unlikely that the bones referred to are those of victims of any such epidemic. There is still less evidence in favour of another theory, viz. :—that the skeletons are the remains of men killed in skirmishes in the neighbourhood during the middle ages: quite recently I examined some of these remains which had been removed from beneath a house, and found them to be largely derived from children. I think there can be little doubt that a burial ground existed there in very remote times. Scotter is very ancient, once ranking as a market town, and it is probable that the present graveyard, crowded though it is, has not always served as the burial ground of its people. This is borne out by a tradition which seems to speak of an older church once standing on or near the Green. The fact that the remains often consist of incomplete portions of skeletons, or are in unusual positions, has no weight against this explanation, for in the centuries elapsed since the burial of the dead the soil must have been repeatedly disturbed. I am told that some skeletons have been found in the fields between the present graveyard and the river, buried in the early Saxon manner, the upper part covered in by stones.

Scurvy is believed to have been common in Scotter and its neighbourhood in old times. Previous to the present century the people lived largely on rye or barley bread, and salt beef or other salt meat: they grew few vegetables, but had near their houses small plots of ground for pot herbs, and at the rear large hemp yards. These hemp yards have now been converted into kitchen gardens and orchards, the cultivation of hemp and flax for weaving having been discontinued early in the century. The dietary habits of the people have marvellously changed, and scurvy has entirely disappeared; the last case seen in Scotter being about twenty-five years ago, in an old man who lived alone and had no garden. I have, however, seen one recent instance in another parish. The name is now popularly misapplied, any comparatively innocent skin disease being called scurvy.

Ague was formerly prevalent in the neighbourhood, though not to the same extent as in the fens; the last cases originating here occurred about forty years ago, and were contracted in the peaty moorlands west of Scotter and Messingham. Three cases of different forms of ague seen by me in this neighbourhood have all had their origin elsewhere: one in Ashantee, a second in India, and in a third case the disease had been contracted about sixty years before in the neighbourhood of Market Rasen, but reappeared in old age after a dangerous fall.

Cholera raged at Gainsborough and Owston Ferry in 1832 and 1849, and several victims from East Ferry were buried in Scotton churchyard; but the disease never obtained a footing in Scotter, though my father attended one fatal case at Susworth, doubtless brought on through drinking Trent water.

Small-pox was once an exceedingly common and fatal disease in Scotter and neighbourhood; all of us over thirty-five years of age can remember "old standards" whose faces bore evidence of the terrible nature of this loathsome disease. Latterly it has disappeared, no case having occurred in this parish for thirty or forty years.

Up to ten or fifteen years ago, Scotter was notorious in the neighbourhood for its "fevers"; a notoriety mainly earned through the frequent occurence of epidemics of typhoid fever. Two reasons can be assigned for this:—first, the existence of gross surface nuisances in almost every part of the village, due to neglect of out-door cleanliness; and, second, the nature of the water supply. The cause of the general neglect of sanitary matters out of doors consisted in a deep-rooted scepticism on the subject amongst most of the villagers: while scrupulous cleanliness could usually be observed indoors, dangerous filth was very commonly permitted out of doors, often within a few feet of the houses. Men and women were alike in this; the same housewife who in her person and house was the picture of neatness, not seldom was entirely careless of out-door sanitation. The water supply, which is exceedingly abundant, is derived partly from rainfall; and partly from underground currents coming down the hill from the direction of Scotton Common. In the lower parts of the village the subsoil water sometimes rises to within a few inches of the surface, the wells in consequence are very shallow, often not more than six to twelve feet deep. The result of this was that heavy showers invariably washed much filth into these wells. Most of the epidemics occurred after a dry time when rain first fell, for the wells had become low in water, filth had accumulated on the surface, and the rain carried a concentrated solution into them. This occurred in 1868; the summer was one of almost unexampled dryness, the harvest being several weeks earlier than usual: after harvest the epidemic broke out and caused many deaths. In 1843 and 1858 there had also been fatal epidemics, some families being almost decimated, and nurses were procured with difficulty, several taking the disease. In these epidemics, owing to neglect of the proper precautions, single cases were exceptional, usually there were two or more in each house attacked. The records of pauper sickness and mortality kept by my father from 1839 to 1881 bear striking testimony to the prevalence of typhoid fever; in the forty years between 1839 and 1879, no less than seventy-two cases were treated by him as paupers. Now if the total annual number of paupers in the village is set down as fifty, this would give more than 1000 cases during that time in the whole population of the village: there is, however, good reason why such an enormous number cannot be a real fact; typhoid fever is a disease of some weeks' duration, therefore a much larger proportion would ultimately come under treatment as paupers than would be the case with ordinary diseases. The real number in the whole population cannot be arrived at, but it is certain that it was enormous. No less than eight cases occurred amongst the paupers in the earliest recorded epidemic of 1843, and no less than nineteen cases in the seven years from 1868 to 1874 inclusive; after this fewer cases are recorded.

In 1882, my own experience of practice in Scotter began; shortly, it has been this:—typhoid fever has almost disappeared; in the last eight years there have not been more than five cases, excluding those introduced from a distance, and all have been of exceptional mildness. On the other hand, pneumonia has greatly increased. What is the explanation of these facts? At first sight it looks as though the two diseases were mutually antagonistic, that the one cannot exist in the same village with the other; but such an explanation, though striking, is not the real one, for the two diseases have not behaved in this way elsewhere. At Middlesbrough, where pneumonia was epidemic in 1888, typhoid fever has recently been epidemic too, and many other like instances might be found, some even in which the two diseases were epidemic side by side.

It is within my memory that my father considered the epidemic of typhoid in 1868 due to filth washed into the wells by the rain water; and in 1875, with a view to cutting off this possible cause, he began to drain the lowest part of Scotter, in order to rapidly carry off storm water; and, a year or more later, the remaining higher parts of the village were similarly drained. This source of water supply being largely cut off, the wells were more confined to the purer underground supply which comes down the Gainsborough hill, in never-failing springs, from the direction of Scotton Common. This, I have no doubt, is the true explanation of the gradual and now almost complete disappearance of typhoid fever from Scotter, a disease which had previously been the curse of the village, and had given it an unenviable notoriety for miles around. But what is the cause of pneumonia cropping up just when the old pest had departed? When the drain at the west end of Scotter was laid, it was not primarily intended to be used as a sewer, certainly not to take solid sewage; the streets, ditches, and yards of this part of Scotter were often flooded; the object then was to carry the rain-water quickly away, and it was not thought necessary to employ the safeguards needful to a sewer taking solid sewage. Up to the present time the western drains have not been extensively used as sewers, but the case is different with the large main sewer at the south end of the village; as time passed on, it came to be used more and more as a sewer, until, at the present time, it chiefly serves that use. The disappearance of the one disease, and the increased prevalence of the other, have, I think, been brought about by the same agency—the drainage works; their primary use, the carrying away of storm waters, having largely assisted in the eradication of typhoid fever; their use as sewers without safeguards having been one main agent in the production of the outbreaks of pneumonia.

PNEUMONIA IN SCOTTER IN 1886.

The first noticeable epidemic of pneumonia occurred in 1886, beginning in January, and ending in June. In the same months of the previous year there had been a severe epidemic of erysipelas, necessitating the postponement of the half-yearly vaccinations. The erysipelas was chiefly on the same ground as the pneumonia which followed, though not in the same houses. Several of the cases began with an inflamed throat, and other unusual parts were attacked. The worst case was in a new arrival, Mr. Neil Campbell, who with his comrades was then engaged in the Ordnance Survey. I may mention, as showing the adverse influence at work in Scotter that spring, that I attended nearly all these unfortunate strangers with more or less serious ailments; but Mr. Campbell narrowly escaped with life: his attack began with an inflamed throat, and appeared to come to an end suddenly with diarrhœa, but he quickly relapsed, the erysipelas showing itself in other parts, and for several days he was in urgent danger, rambling constantly in his Gaelic mother tongue. He and a comrade, also ill, lived on the "Sands" in the old Workhouse. A fatal case of erysipelas has since occurred in one house, and several cases of throat disease and diarrhœa in the only other house opposite; while in 1890, in a house next door, a woman died of pneumonia, and all her children have since had diarrhœa and vomiting, one of them dying.

The pneumonia epidemic of 1886 occurred chiefly at the western end of Scotter. The cases were of ordinary severity, far milder than those seen in 1890: of nine cases all recovered but one, nevertheless there is no doubt in my mind that this disease was identical with that which subsequently committed such havoc in 1890, and which had occurred in isolated cases previous to 1886. My reasons for this belief are various; I may mention here the likeness that struck me most, viz.:—the exact resemblance of the symptoms. The characteristic symptoms which enabled me to recognise the 1890 disease as the same as that described by Dr. Ballard in his report on the 1888 epidemic at Middlesbrough, had nearly all been noticed in this 1886 epidemic. The great difference in the mortality of the two Scotter epidemics is a changing character frequently observed in different epidemics of other diseases: one special reason for this difference will be mentioned later on when describing the sanitary condition of the village. Of the nine cases eight were males, four of them being children under twelve years, all of whom recovered; the mortality of the five adult cases was thus 20 per cent., a marked contrast to the 72.2 per cent. mortality in 1890. The nine cases occurred in eight houses, one house having two cases, including the fatal attack. Erysipelas, diphtheria, epidemic quinsy, diarrhœa, or other affections having similar causes have been more or less prevalent in nearly all, probably in all these houses, either shortly before or since the pneumonia, and I have already noticed the occurrence of erysipelas in neighbouring houses. I can call to mind the names of twenty nurses who nursed these nine patients: only one took the disease; and the history of the case renders it highly probable that the man contracted it from the same source as his little son did. The boy's case was the first of the series. The house was notorious for its unhealthiness, the children who had lived in it from time to time being frequently ill. Ten years before, a preceding tenant, a middle-aged man, had died of pneumonia. Erysipelas had occurred in this and the next house more than once, and since 1886 I have attended in illnesses which I am confident were due to similar causes. It wonld be interesting to know the class of cases attended by my father and grandfather. I have heard my father speak of "fevers" and diphtheria occurring in it.

These facts render it probable that the father, who by the way did little nursing, but was chiefly engaged in the fields and in the yard amongst his pigs, contracted the disease as his son probably did, through the medium of the foul yard close to the house, or, more likely still, from the untrapped and uncared for sewer, the inlet of which was in front of the house door, so that a person standing at the door could readily throw slops into its open mouth. 1 do not think that there can be any reasonable doubt that emanations from the foul soil, yard, and sewer, surrounding the house, were the real cause of nearly all the illnesses occurring in it.

The subsequent cases of the series were not in persons who had nursed these or any other patients, and all but one lived in houses some distance away, and had nothing in common except obvious insanitary conditions.

DRAINAGE OF SCOTTER.

The drainage of Scotter is in two distinct sections. One consists of a large main sewer with branches, draining the southern higher parts of the village; this may be called the south sewer: it drains all or nearly all the eighty-six houses standing near it.

The other section consists of three small sewers at the western end of the village, each having a distinct outfall; these may be called the west sewers: they drain about one-fourth of the houses in this part of the village, the remaining three-fourths being unconnected with any public sewer.

The South Sewer.—This is by far the largest in the village. It was at a house in connection with it that the first case of pneumonia occurred in 1890, and the majority of all subsequent cases have been scattered along its course. It begins at the south or Scotton end of the village, runs along the main street as far as the road leading to Messingham, turns down that road and falls into the river Eau, near the bridge—about 630 yards in all. It consists of nine-inch sanitary pipes, except a short length of six-inch pipes extending from the beginning of the sewer to the school. It is laid at a depth of about eighteen inches, and the soil in the higher parts of Scotter being gravelly and dry, it gets no drainage water through its open joints, but receives the surface rain-water at its inlets. The fall is excellent, the ground descending from a height of over fifty feet at the beginning to nineteen feet near the outfall. It has three main branches besides those from single houses and small groups of houses. The first branch, from a row of six houses on the east side of the Green, consists of nine-inch and six-inch pipes—much too large for the purpose. It was in the highest of these houses that the first case of pneumonia occurred. The second branch comes from the Gainsborough road, beginning opposite the Primitive Chapel and crossing the road twice before it reaches the main sewer. No case of pneumonia occurred in the eight houses draining into this branch in the outbreak of 1890, but an acute case of "lung congestion," without pneumonia, occurred in one of them on May 9th, 1890, the day before the drought broke up, and a decided case of pleuro-pneumonia occurred in another in the epidemic of March, 1891. The last branch comes from five houses near the spot where the main sewer turns down the Messingham road; but instead of joining the sewer immediately, it runs parallel with it down that road nearly to the outfall, and then joins it. This branch, therefore, is more distinct from the main sewer than either of the others. No pneumonia occurred in 1890 in the five houses draining into it, but two cases occurred in two of them in 1886, and a third case in a third house in March, 1891. In past years, typhoid fever caused several deaths in these houses, and in recent years I have attended diphtheria or erysipelas in three of them, and a great amount of sickness in all. The inlets to this branch were untrapped at all five houses. It is not improbable that this branch was the means by which the pneumonic poison penetrated from the western portion of Scotter, where it largely found lodgment in the soil, to the southern portion, and especially to the south sewer. The slowness with which the latter sewer was dangerously infected is perhaps explained by the fact that this branch joins the main sewer near its outfall (see plan). The work done by the south sewer and its branches for some years past has been as follows:—it receives slops and other liquid refuse from eighty-six houses; drainage from four or five farm-yards, two slaughter-houses, and the school urinal; and solid excreta from one w.c. It also takes the surface rain-water of the higher parts of Scotter, but the spout-conductors do not usually connect with it directly. All the houses along its course, with a very few exceptions, drain into it, as they have no independent drainage. The inmates of the few houses not connected with the sewer follow the old custom of throwing their liquid refuse into the town street or their back yards. At the time of the outbreak, there were six rain-water inlets into the main sewer besides others into the branch sewers; one near the outfall was a naked pipe; four in the main street, old-fashioned, nominally trapped inlets; and one at the beginning of the sewer, a new street gully. The four inlets in the main street with the old-fashioned "mason's trap" were all situated below the School; they consisted of a brick catch-pit cut off from the sewer by a slab, which, when water was in the pit, acted as a trap. Unfortunately, these pits would not hold water long, as it more or less quickly percolated through the porous bricks into the dry, gravelly soil beneath: consequently these four inlets in the middle of the village were more frequently untrapped than trapped, and even in wet weather sewer air was said to escape freely through the crevices in the decayed woodwork of the frames. More than this, it was the invariable practice to leave the catch-pits dry when they were cleaned out. The result of all this was that these inlets acted as so many ventilators of the sewer, and gave rise to much annoyance to those passing along the pathway and those living near. The inlets in the back yards of the houses were often untrapped, consisting of a naked pipe, with a depression in the ground to receive slops; or there was a catch-pit of mortared or unmortared brick; in other instances the catch-pit was covered in by a D trap fitting into a frame of wood or stone, but these traps were necessarily loose and removable in order that the catch-pit might be emptied of sediment. In a few rare instances gullies were attached to the inlets. Thus it will be seen that this sewer had the work of a sewer, without its safeguards. It was mostly untrapped, wholly unventilated, unflushed except in wet weather, and its joints were open; no one thought anything about it except when complaint was made of the stench, and that was deemed an unavoidable evil. Its natural advantages of fall prevented it being blocked up, but the abominable smell at the outfall when rain fell after a dry time, and the quantity of foul, black sediment then washed out, discolouring the river water for some distance, shewed that considerable deposit did habitually take place in the pipes, but that it was cleared out when heavy rains fell; or, rather, this was accomplished in the greater part of the main sewer, though not always in the upper part beyond the School, for as recently as the previous winter all these six-inch pipes became blocked and had to be relaid, and it was then that the new street gully spoken of was laid in place of the pre-existing contrivance. Such was the condition of the south sewer at the time of the outbreak: I have to add that there was only one bath connected with it, and that the inhabitants generally practised no systematic flushing by means of pumps, etc.

The West Sewers.—This section consists of threeshort sewers, having distinct outfalls. As already explained, they were laid chiefly for surface drainage to prevent the flooding which had previously been common in this part of the village. They are laid much deeper than the south sewer, evidently with the object of draining the saturated soil by means of their open joints. They also take slops from about twenty houses, and drainage from a few small farm-yards, but no w.c. or slaughter-house drains into them, and it is evident that all three sewers with distinct outfalls do not carry one-fourth part as much sewage as the south sewer does with only one outfall, probably not more than a sixth part. The inlets to these sewers were very similar to those already described as existing in the south sewer, and I have little doubt that the filthy condition of the western inlets, with the gross surface filth around them and the houses generally, had a real causative connection with the 1886 epidemic of pneumonia; yet the west sewers were in a far less dangerous condition than the south sewer, for they received a great excess of surface and subsoil water, while the latter received much sewage and little water. Late in June, 1890, I examined the contents of the largest of the western sewers, while street gullies were being put down. This I could do as the outfall was blocked through cattle having trodden in the ditch. Nothing but liquid could be seen, and it appeared to be little more than discoloured rain-water; I perceived no smell. Is it possible that this difference in the degree of foulness of the two sewer systems—south and west—had to do with the four-fold difference in mortality of the pneumonia epidemics arising from them? The south sewer draining eighty-six houses and the west sewers twenty, there remain seventy-four houses in Scotter village unaccounted for. These are mostly in the western part of the main street, but a portion are in the back lane running parallel with it, "The Sands," and the rest are situated on one or other side of the River Eau. They vary much in their drainage and general sanitary condition; the western part of the main street has abundance of garden space attached, and many of the houses on the north side have direct access to the river through ditches. Some of the drains running from the houses to neighbouring ditches are of sanitary pipes, more are of common field or horse-shoe pipes; some are kept in good order, while others are foul; almost all were untrapped in 1890. A few empty into cesspools of naked brick, the liquid portion draining into the soil, the sediment remaining. Other houses have no drainage at all, and necessarily the sanitary condition of such varies greatly according to the care taken in disposal of liquid refuse. It is a suggestive fact that these houses without drains have, during the last nine or ten years, had far greater immunity from pneumonia than those with drains. The lesson to be learned from this fact must be that it is better to have no drains at all, than to have them bad and neglected. It must not be supposed that in saying this I am condemning sewers. Surface drainage has done much for Scotter—it has banished typhoid fever. Good sewerage will, I trust, banish this disease as effectually.

THE FATAL PNEUMONIA OF 1890.

So far as is known, there had been only one decided epidemic of pneumonia in Scotter up to the year 1890, and it has already been described as occurring in the first half of 1886. I have, however, records of at least twenty cases seen in the five years, 1884 to 1888, the first year supplying four cases. Most of them occurred in the earlier half of the year, some in the autumn. No case was seen in an unsewered house. The yearly average would be four, a proportion of cases to inhabitants probably more than twice as great as in surrounding villages, in several of which I saw none in all those years.

The influenza epidemic of 1889-90 had been very general in Scotter and neighbourhood (*see* influenza epidemics), but it is a remarkable fact that not a single case of pneumonia accompanied it in Scotter. More than this, the whole Registration Sub-district, population 4,088, had only one fatal case in an adult and one in a child during the first three months of 1890, the period when influenza was most rife. Of equal importance is another fact: not a single death from pneumonia occurred in the sub-district outside Scotter and Scotton in the following three months ending June 30th, during nearly the whole of which time pneumonia was raging at Scotter with appalling fatality. These facts point to the conclusion that the fatal epidemic which I am about to describe was entirely a local manifestation, that it originated in Scotter and spread from it as a centre; and that it was independent of weather conditions. They also show it to have been independent of influenza, as influenza, though it is possible that the two diseases may be due to poisons having a common origin, but modified by propagation in different media.

The fatal epidemic of 1890 began amongst the adults early in April, a month or so after influenza had ceased to be prevalent in the village, though it was still common in one or two villages near. From the last week of March, however, there had been much sickness amongst the school children, characterised by vomiting and headache, with or without fainting, fever, sore throat and diarrhœa. This sickness attracted little or no attention and I heard nothing about it for some time, illness of this nature being very common amongst children. Such attacks were attributed to "catching cold," or eating indigestible food. Some parents, however, laid the blame on the school premises, averring that their children were always ailing while at school, but remained well when kept at home; others again were unable to suggest a cause. The illness in 1890 was evanescent in character, some children were better in a few hours, never ceasing attendance at school, others were ill for one or more days and then returned to school. A large proportion of the school children suffered in this way. Their illness was markedly distinct from the fatal pneumonia in adults, in that they were equally affected in all parts of the village, whereas the pneumonia was almost entirely confined to one street and to one half of that particular street. I shall enter into this interesting point later on. Only one of these children had pneumonia, she lived a mile and a half out of Scotter, and came to school every day. Her case is unique, as her father died of pneumonia shortly afterwards, and there is no other undoubted instance of two cases in one house; the father, however, was in the habit of coming to Scotter almost daily. I am unable to say whether children and adolescents not attending school had this mild sickness; it is certain that a few adults were laid by for short periods with similar symptoms. Only one case of pneumonia was seen in a child not attending school—an infant, the only child in the house, living close upon the main sewer.

The weather preceding the fatal pneumonia had been unusually dry and open; the rainfall in January was below the average, though only slightly so, but each succeeding month was exceedingly dry. From the latter part of March to about May 7th, there was so little rain that farmers, who are always observant of such matters, agreed they had never known so dry a spring.

The first case of pneumonia occurred in an old thatched house on the south-east side of the Green. The victim was Mr. James Barker, an old man of eighty-two, healthy and fairly active, spending his days about his house, yard, and garden. It is known that he had not been out of Scotter for some time, probably over a year, and this with the fact that no pneumonia had been observed in Scotter for fully a year, and that he lived alone, tends to show that the disease was not introduced from outside, or due to any mere contagion from a preceding case, but was a repetition of a process which had been going on in Scotter almost year by year.

After Barker's, on April 6th, there came a succession of cases, in batches of two or three about the same time, all through the month of April and early part of May. The most striking feature in this rush of cases was their enormous fatality and partial distribution. Most of the cases, especially the earlier ones, occurred in the rows of houses on the east side of the main street. Ten cases were seen in these houses, and two in houses opposite, making twelve cases in this portion of the main street, while the whole of the western portion, which had seven attacks in 1886, had only one in 1890. Besides these there were three cases in other parts of the village, two on "The Sands," and one, my father's, on the far side of the river. One of the patients on "The Sands" had apparently contracted the disease at the houses first mentioned, for he had lived in one of them up to a few days of his seizure, and had passed backwards and forwards after the "flitting."

These are all the cases that occurred in the village in 1890, but there were four others scattered through the outlying parts of the parish in persons coming to Scotter almost daily. It will be seen, therefore, that half of the twenty cases distributed throughout the parish occurred in the houses first mentioned; in other words, these forty houses had ten cases, while all the rest within the parish boundaries, 217 in number, had only the same number. This distribution of the cases on the east side of the main street, is so striking and important that it will be well to enter into a close analysis of them.

The forty houses indicated are those on the east side of the main street and the south-east side of the Green, beginning at the south or Scotton end of the street, and terminating at Mr. Major's corner, where the Messingham Road joins the main street, 530 yards in all. The houses are mostly small cottages, many have but one sleeping room, others have two, and a very few three. There is no farm-house amongst them, one formerly used as such having been divided into tenements. In April 1890, these houses had 137 inhabitants of all ages, an average of 3·4 persons to each house, many of them having only one inhabitant each. The proportion of cases of pneumonia in them between April 6th and June 21st, 1890, was therefore one case to every 13·7 persons, while all the rest of the village proper, with five hundred and sixty-three inhabitants had six cases, or one in 93·8 persons.

The following statistics show the age distribution of the cases of pneumonia:—

The 40 houses had 137 inhabitants; 60 under 20 years of age had one case of pneumonia; 77, aged 20 and above, had

9 cases; 39, aged between 20 and 50, had one case; 38, aged 50 and above, had 8 cases; 6 persons, of 80 and above, had 4 cases.

These figures refer entirely to the 1890 pneumonia and do not include any case occurring since then. Nor has Fieldston (the man who moved away just before his illness) been reckoned amongst them, though this might in fairness be done.

The proportion of cases to inhabitants at the different age groups is as follows:—

Persons of 20 and under had one case in 60; persons over 20 and under 50, had one case in 39; persons of 50, but under 80, had one case in 8; persons 80 years of age and over, had one case in 1½. The attack at ages under 20 was in a male infant already mentioned. The single attack in persons between 20 and 50 was in a woman aged 48. The four attacks at the ages of 50 and up to 80 were in two women, aged 61 and 63 respectively, and two men, aged 50 and 65 respectively. The persons of 80 and over were one man aged 82, and three women, aged respectively 80, 82, and 84. Three of the ten persons attacked recovered, viz.:—the infant, the man aged 50 and the woman aged 48.

The proportion of old people to younger ones was much greater in these houses than elsewhere, for an unusually large number of aged persons lived in them. The mortality amongst these old persons was truly appalling.

It is noteworthy that both the old men who escaped the pneumonia had previously passed through attacks of erysipelas: one recently, the other some five years before. One of them was probably removed beyond the causal influence of the disease. Three of the old people who died lived alone, they were hardy and strong, one was marvellously robust, and bid fair to become a centenarian. She struggled gallantly with the disease for five days. The disease fell with terrible and decimating force upon old people and elderly females; as a rule it passed by houses where the young dwelt. In a word it singled out just those who, owing to advancing years, did not go into the fields to work, but stayed all day long near their own homes. There seems no escape from the conclusion that the cause of the epidemic was located around these houses, that it was virulently active there, but inoperative at most other parts of the village; indeed, it is highly probable that several of the remaining cases had their origin here also. The cause, whatever it might be, was distributed throughout the houses, there being hardly an instance of six houses passed by without an attack, and in two instances neighbouring tenements were invaded.

The dates of the ten attacks are as follows:—Mr. James Barker, April 6th; J. V., April 11th; M. H., April 11th or 12th; J. A. F., April 23rd; H. C., April 24th; H. S. about May 1st; infant R., aged 16 months, May 3rd; F. H., May 12th; J. N., June 8th; G. V., June 21st. Four were males, and six females. The dates of the ten other attacks are as follows:—

1. On opposite side of road to above cases:—E. D., April 22nd; E. C., April 23rd or 24th.

2. On "The Sands" and in other parts of Scotter:—E. F., April 13th; E. H., April 21st; W. F., about April 24th; R. E., May 8th.

3. In outlying parts of the parish:—J.'s daughter aged six years, April 14th or 15th; G. H. J., April 26th; H. C., May 1st; R. A. C. E., May 19th.

Of this last group of ten cases, seven were males and three females; the marked difference in the two groups lying in the fact that an unusual number of elderly females lived alone in cottages on the east side of the main street. The ages of the males were as follows:—33 years, 37, about 40, 41, about 50, 59, and 80 years. Those aged 33, 37, 41, 59, and 80, died, the eldest living three times as long as any of the others. The ages of the females were:—6 years, 31 years, and 48 years; the first and the last recovered. Of the twenty cases occurring in all parts of the parish in 1890, eighteen were adults, and two children, both the latter recovering. Thirteen of the adults died, a mortality of 72·2 per cent. Ten of the adults were males, three recovering; and eight were females, two recovering.

A most interesting and important feature of the epidemic was its almost abrupt cessation after the heavy rains of May 9th, 10th, and 11th. This fact, considered in connection with the prolonged and excessively dry weather which accompanied the epidemic, is a point of such importance, that a detailed account of its circumstances will be given when dealing with the causation of the disease.

Having given a general sketch of the epidemic in Scotter parish, I will pass on to the outbreaks at Scotton and Messingham, describing them finally. We shall then be able to return to a fuller consideration of the Scotter outbreak, and especially of its causation.

PNEUMONIA AT SCOTTON.

UNTIL May 3rd, that is for nearly a month, the pneumonia was confined to Scotter parish, but on that date a case occurred at Scotton, which is the nearest village, lying one mile southwards. Shortly afterwards the disease appeared at Messingham, two miles north of Scotter. Early in September a man died of acute congestion of the lungs at Northorpe, a small village three miles south of Scotter; he had the sudden onset and other symptoms of pneumonia, but died before lung inflammation had time to show itself. Later in September, an undoubted case occurred at Laughton, four miles south-west of Scotter. Thus the villages around were attacked in the order of contiguity to Scotter. There can, I think, be little doubt that these successive outbreaks were really extensions of the disease from Scotter; the entire, or almost entire, escape of the more distant of tho fourteen civil parishes of the sub-district, points strongly to this conclusion.

Three cases only occurred at Scotton, all in houses on the side of the village nearest Scotter. The first case was that of T. C., aged fifty-seven, a man of industrious and stay-at-home habits. Careful enquiry was made to discover any outside means by which he might have contracted the disease, but nothing could be ascertained. He had not been to Scotter for a month before his attack, and then had only passed through the village, nor had there been any recent communication through letters, parcels, or visitors. The out-door premises, however, were in an insanitary state, there being much liquid sewage near one end of the house, which drained off through common sough pipes. This drain passed close by the house door, and there were several untrapped inlets into it, one being under the pump, within a foot or two of the house, and near the door. The outfall of this drain was into a ditch over which was the footpath to the house, the ditch emptying by an untrapped opening into the main horseshoe sewer of the village, the whole surrounding the house on three of its four sides. The only facts elicited by enquiry were that one or two inmates of the house had shortly before suffered from diarrhœa and vomiting, and it seemed clear that their illness was connected with the condition of ordure close to the house. The patient died.

The second case was in a young girl, aged ten. Her illness began on May 10th, and she recovered after a well-marked relapse and second crisis. There had been no recent communication with Scotter, and no communication whatever with the preceding case of T. C., which was some distance away. The house stands on high ground a few yards above Cracklewell. The bedroom where the girl slept was very small, entered by a trap-door, and so low that an adult could not stand erect. The cubic space was not more than a fourth part of that of an ordinary bedroom, nevertheless, two adults and two, I believe three, children slept in it. Almost immediately beneath the window was the only inlet of a sewer, which descended steeply to the lower ground. In this inlet was a broken D trap, hence it was entirely unprotected.

The third and last case was in a farmer, J.C., aged sixty-nine, healthy and robust, who was attacked on June 19th, more than a month after the preceding case. He had been to Scotter on the 17th, but only for a few minutes on his way from market. The house at which he stopped was on the west side of the Scotter main street, opposite where several cases of pneumonia had occurred, but there had been no case in it, and it is believed he took no food. His own premises were in a singularly insanitary condition. The crew-yard lay near the house door, and was wet, but within a few feet of the door was a walled-in pig trough which did duty as a receptacle for slops, being handy for that purpose. From this trough the liquid refuse overflowed into a naked sewer pipe, set in farm-yard manure, and this communicated directly with the horseshoe sewer previously mentioned. The patient died on July 1st. The only feature common to all three cases was the grossly unhealthy surroundings of the houses where they occurred. There was no other case in Scotton during the epidemic period, but four months later a supposed case occurred; and during the recent epidemic of influenza I have had two cases, one fatal, in an infant in a house near Cracklewell, where the girl had pneumonia, the premises remaining as described; and the other in a farmer, aged eighty, who has made an excellent recovery, in a house near the old horseshoe sewer out-fall.

There was no general sickness, such as obtained at Scotter, amongst the children of Scotton, but there was a prevalence of diarrhœa and vomiting amongst adults at that time, and in the same street with the two adult pneumonia cases, I attended a woman, from August to December, with erysipelas and sore throat. The erysipelas began early in September, and was exceedingly severe, so that for nine months afterwards she walked with crutches, and at the present time has not regained perfect use of the affected legs. It is noteworthy that at the same time I attended two cases of erysipelas in Scotter, both in houses connected with the south sewer. The house where the woman lived at Scotton stands on the highest ground of any connected with the Scotton horseshoe sewer (the same with which T. C. and J. C.'s houses were connected). The inlet is about three yards from the house door; it is untrapped and immediately under the pump. The smell from it was very perceptible, and the well water stank, owing apparently to soakage from the sewer.

PNEUMONIA AT MESSINGHAM.

On May 31st, the epidemic broke out at Messingham, a village standing two miles north of Scotter, on much higher ground. The first case was that of W. M., aged fifty-six, a farm-labourer living in Low Well Lane. Close enquiry was made to ascertain if there had been any communication with Scotter, but no history to this effect could be discovered. The man was unusually intelligent, and of sober, quiet habits. He assured me that he had not been to Scotter for over a twelvemonth, and he and his wife agreed that they had of late had no letter, parcel, or visitor from Scotter. Near his door was an inlet into a drain, communicating with the village sewer; it had a loose D trap fixed in a frame. The house door is in a corner, and the inlet about three yards from it, so arranged that currents of air might carry sewer air directly into the house. In the street close to his gate there was a rain-water inlet, which the Vicar informs me was untrapped and a source of complaint.

The second case occurred next day, June 1st, and was in a man living in Little London, on the southern outskirts of Messingham, at an elevation of considerably over one hundred feet. Not only had there been no communication between the two cases, but the man told me he had not been in Low Well Lane for a very long time. A year before, I had attended in this house a well-marked case of diphtheria, which I attributed to a foul inlet into a sewer of field sough pipes running to a neighbouring ditch. The inlet was five or six yards in front of the house door and close by the entrance gate. Just before the man's illness this inlet and sewer had been torn up to put down sanitary pipes. The man had, I believe, stayed away from his work a few days before his illness, and thus would be more exposed than usual to emanations from the fouled soil.

The third case was in an old man of seventy-eight, living in the main street, far removed from both preceding cases. About three yards outside the house door was an inlet into the main sewer, closed in by walls except in the direction of the door. In it was a loose D trap, broken and useless. Owing to the position of this inlet, sewer air could hardly avoid entering the house, the door being often wide open.

It would be tedious to proceed with this description of the surroundings and circumstances of each case; suffice it to say that in all cases defects as glaring appeared to be the producing cause. They consisted of unprotected or imperfectly protected inlets to sewers; and near some of the houses there were other defects of a gross nature, such as a pig-sty over the well, filthy privies and pig-sties, and an excessively foul fold-yard close upon the house, with untrapped pipes for slops running from inside the house to the manure. At one house there was a curious old sewer, said to be large enough for a man to creep down, constructed of upright stones, with loose stones for the floor and roof. There were two untrapped inlets into it, one under the pump within a few feet of the door. The house stands high, and lower down in the course of this sewer was a large covered and unventilated cesspool. It is said to be a remnant of sewerage works constructed by an archdeacon at the beginning of the present century.

The disease history of Messingham is similar to that of Scotter, except that typhoid fever has not been so distinctly epidemic. Within the last few years, however, I have attended several cases of a mild character, some of which occurred in houses under the same roof as these cases of pneumonia, or in the same yards. In 1881-2, before the present sewerage existed, there was an epidemic of diphtheria which carried off many children and even adults. With the cases of pneumonia in 1890 there was a wide-spread epidemic of diarrhœa, several persons dying.

The sewers of Messingham consist chiefly of a large main sewer and several large communicating branches. The fall for the most part is moderate, much less than the Scotter south sewer has, and the pipes are large in size. The rain-water inlets in the main street are trapped, but those in the branch lanes are mostly untrapped. At the time of the epidemic the private inlets were fitted with loose D or bell traps having catch-pits underneath, or were untrapped. I had no means of knowing what the condition of the interior of the sewer was until after the epidemic was over, and repeated heavy rains had fallen. At one house I have, for some years past, attended several members of the family for persistent and extreme pallor, faintness, and shortness of breath. Recently I have attended a case of pneumonia, and about this time all the inmates suffered in one way or other. Internally the house appeared remarkably healthy and well-ordered, and the habits of the occupants were conducive to health. The back yard was small and closed in by walls. Four yards in front of the two kitchen doors, and mid-way between them, was an inlet to the sewer with a catch-pit and loose bell trap in a frame of stone. The smell from the catch-pit when opened was very nauseous, and it was evident that sewer air could readily escape between the foul bell trap and the stone frame. About eight or nine feet above this was the open window of the bedroom where most of the persons suffering from anæmia had slept at the time of their attacks. To be short, these investigations led to the large sewer in the main street being opened, and it was found to contain much black deposit, giving off an abominable stench that pervaded the neighbouring yards for some time.

Multiple cases were entirely absent at Messingham, and no nurse contracted the disease. Two only of the ten patients had visited other cases before their attacks. In one case, however, there was an interval of four weeks between visit and attack. In the other the visits were frequent, food being taken in the house, and there was exposure to exactly the same grossly unhealthy conditions which, I feel sure, had caused the visited case, and it is noteworthy that, early in the year, I had attended a case of throat inflammation of an erysipelatous character.

There was no general epidemic amongst the school children at Messingham. The reason for this may perhaps be found in the absence of the special conditions obtaining at Scotter, and in the lateness of the season.

Of the ten patients contracting the disease at Messingham, eight were males and two females. The males were aged 78, 69, 57, 56, 46, 37, 35, and 30; those aged 57 and 37 recovered. The females were aged 65 and 21; both recovered. The mortality of all cases was therefore 60 per cent., while in the males it was 75 per cent. The greater incidence of the disease on males was very marked. I am inclined to connect this, as well as the long intervals between the cases, with the fact that the epidemic only attacked Messingham after the heavy rains had fallen. The sewers were no doubt partially cleansed, but not entirely, for the fall in many of them is defective, consequently the rain could not exert the same flushing power that it did at Scotter. The poison, therefore, did not make such headway as it would have done in dry weather, the cases coming at longer intervals, and the most susceptible subjects—the males—being attacked rather than females and children. The last case was on October 11th. The following table shows the distribution, sex, and mortality of the thirty-one adult cases of 1890:—

Adult Pneumonia Cases of 1890.

	Scotter	Scotton	Messingham	Laughton	Tot.
No. of Cases	18	2	10	1	31
Males	10 (3 recovered)	2	8 (2 recovered)	1	21
Females	8 (2 recovered)	0	2 (recovered)	0	10
Recovered	5	0	4	0	9
Died	13	2	6	1	22

PNEUMONIA AT SCOTTER IN 1891.

From June 21st, 1890 to March 3rd, 1891, no undoubted case of pneumonia occurred in Scotter parish, but on the latter date a case was seen at the south or Scotton end of the main street, and this was succeeded by four others, the last being on March 19th. All five were in children, varying in age from about two months to three or four years. All were cases of acute pneumonia, without bronchitis, but in one there was pleurisy. All were in the same part of Scotter, as the majority of the 1890 cases, in close proximity to the south sewer or its branches, but they were in fresh houses. One died, and as its death occurred whilst its mother was carrying it along the village street, an inquest was held, and a *p.m.* examination was made with the assistance of my neighbour, Dr. Behrendt. It was only through this that the cause of its death was discovered, no medical man having seen it during life. Both lungs were found inflamed in considerable portions of their substance.

At the same time an adult case was seen at Blyton, a village near Gainsborough, in an innkeeper. The cellar where he was accustomed to draw beer and liquors was subject to flooding. To rectify this, a hole had been made in the wall, and sough pipes carried from it to the sewer of the yard. Just before his attack, the only other inlet to this sewer, a few feet from the back door of the house, had become blocked with sediment, a pool of liquid effectually sealing it, the sewer, therefore, could only ventilate by means of the untrapped cellar inlet, and in this way sewer air would reach the cellar and house. There was no other ascertainable cause for his illness.

After the above cases there was a short period of quiescence, but at the end of March the second epidemic of influenza began, and with it many fatal cases of pneumonia occurred; these, however, will be more properly described when the influenza epidemics are dealt with.

There was no rainfall at Scotter in February.

CAUSE OF THE DISEASE.

Bacillus Pneumoniæ in Mice.—On May 23rd, 1890, a letter was received from Dr. Ballard, who had heard of the epidemic, asking me to assist him in identifying the disease, as it was suspected to be the same form of pneumonia as that he had investigated at Middlesbrough, two years before, namely a preventible "fever." Dr. Ballard gave me instructions how to proceed; one being to feed white mice on bread impregnated with the expectoration of pneumonia patients, and to watch carefully for results. Much regrettable delay ensued owing to difficulty in procuring the mice, so that it was not till June 13th that I began operations, and it was then thought that the natural season of the disease was so far advanced that the animals would not take it. The result, however, proved different, and it was curious that mice fed on sputa from a fatal case took the disease and died much sooner than those fed from non-fatal cases; showing, I think, that the length of the incubation period of the disease may have some direct relation to the severity of the case from which it is derived. Thus, mice fed from a patient who died, showed signs of illness in six or eight hours, were hopelessly ill in twenty hours, and died in thirty hours, having had but one meal; whilst others, fed from patients who recovered, did not show signs of illness for twenty-four to forty-eight hours, and only died after four to seven days. Mice fed on sputa of later cases at Messingham, only showed slight signs of illness, and none died.

The mice as they died were forwarded immediately to Dr. Klein, in London, and he found them affected with pneumonia of both lungs, in its earlier or later stages. Subsequently I was informed that Dr. Klein had succeeded in isolating the same minute organism—the bacillus pneumoniæ—which he had discovered in the Middlesbrough pneumonia cases.

The above narrated experiments are of the utmost importance, for they finally prove that this Scotter disease is, as my father suspected, a preventible "fever," the same fever that prevailed to such an alarming extent at Middlesbrough in 1888. They show that it is due to a specific organism, the bacillus pneumoniæ of Klein; but they do not show how that organism commonly obtains entrance into the human body. Knowledge on this latter point is also most important, for without it we should be working in the dark. Useless and irksome precautions might be practised on the one hand, and needful measures entirely omitted on the other. It is to this point therefore, that we have now to address ourselves. Fortunately, information has been accumulating from all quarters in recent times. For many years, I cannot say how many, it has been known that filth and sewer air are capable of causing pneumonia ; but until recently it was not known that they are common causes. In 1874, Drs. Grimshaw and Moore, of Dublin, described a form of pneumonia which they named "Pythogenic Pneumonia," due to such causes; and more recently Dr. Townsend, of Boston, Mass., has given particulars of a large number of cases thus caused. To Dr. Ballard, of the Local Government Board, assisted by Dr. Klein, however, we are indebted for our most complete knowledge on this subject, embodied in the classic report on "Pleuro-pneumonic Fever in Middlesbrough," and in writing this history I have made unstinted use of their labours.

Early in the epidemic, the cases occurring in old persons who were supposed to be worn out, the deaths attracted little attention; but, towards the end of April, when fresh cases were of almost daily occurrence, general alarm began to be felt. At this time I had frequent conversations with my father (the late Mr. Robert Eminson) on the subject, and he assured me that in all his practice in the village, extending over fifty-five years, he had never seen anything resembling this epidemic. A few days later, we discussed the meaning of a fact which had then become apparent, viz. :—that nearly all the cases had originated along the course of the south sewer or drain, and on going carefully over them we found that the majority were in those houses standing nearest it. My father was much impressed by these facts, and requested me to make close enquiry as to the exact condition of the sewer. He also told me that he had long known that the south sewer was not safe, for he had constantly heard complaints of smell from the rain-water inlets, and had himself noticed the stench from the outfall while working in his garden some fifty to one hundred yards distant; and after heavy rains had observed the river water blackened by the foul sediment then washed out of the sewer.

As a result of our enquiries and conversation, we came to the conclusion that the south sewer was undoubtedly the first cause of the outbreak, but in the light of the case of Chantry, who had died that day at Susworth (this conversation took place May 5th, 1890), we also thought the disease was distinctly infectious, and we wrote the same day, my father to the Board of Guardians reporting the outbreak, and describing it by the appropriate term "typhoid pneumonia," and myself to the Medical Officer of the Sanitary Authority, giving particulars of cases I had seen, and my views as to its cause and undoubted infectious nature, and asking the assistance of the Authority. Ten days later, thoroughly alarmed, as two cases had occurred at Scotton, and my father had fallen sick, I wrote in similar terms to the Chief Medical Officer of the Local Government Board. This led to the communication from Dr. Ballard, the important results of which have been already narrated. Later on, in July, at the request of the Sanitary Authority, the Local Government Board deputed Dr. Parsons to visit Scotter, and he issued a report which has engaged general attention amongst medical men to the special features of the epidemic.

The facts which shortly came to light entirely confirmed our early impression as to the part played by the sewer as chief cause of the epidemic, but modified considerably our views as to the influence of simple contagion.

Fevers (using the term comprehensively) as now seen in this country, are of two broad classes:—one large class consists of contagious fevers, such as are spread from person to person by direct infection—scarlet fever, measles, and hooping-cough are good examples of this class. In popular and expressive language they are called "catching" diseases, spreading to all susceptible persons in an invaded house, isolation rarely being possible in this neighbourhood. A second class of "fevers" consists of such diseases as typhoid or gastric fever, epidemic diarrhœa and cholera. They are not contagious or catching as measles and whooping cough are, or very slightly so, nevertheless they are infective, in that they are easily conveyed from person to person if great care is not taken in disposing of the evacuations; but in such cases the infection is not *direct*, it is not caught merely through being in the presence of the sick person, but by means of food or drink which has become contaminated by the patient's excretions. A nurse will not usually take these diseases from her patient if she is careful that her food and drink are untainted, and is particular as to personal cleanliness, but if she is careless in these matters she is exceedingly likely to take them, for besides the dangers indicated, the air of the sick room will become laden with innumerable dry particles derived from the bedding, &c., just as the ordinary atmosphere is laden with fine dust which a sunbeam discloses to the eye.

Multiple cases in a house are less characteristic of this class of disease than of "catching" diseases, such as measles, &c., yet they will occur in not a few instances if scrupulous care be not taken to prevent indirect infection from the patient; or many persons may receive the poison about the same time, not through any known previous case, but from a common source, such as infected drinking water, food, or sewer air.

I propose now to present the facts of this matter as regards the cause of pneumonia at Scotter under three heads:—

(1) Emanations from sewers and surface filth; (2) Contaminated food and air; (3) Contagion.

(1.) Emanations from Sewers and Surface Filth.—There have been twenty-one cases of pneumonia in Scotter village (population seven hundred) in the year beginning April 1st, 1890, and ending March 31st, 1891; sixteen of these occurred in the 1890 epidemic, and five in March, 1891.

The sketch plan of Scotter (frontispiece) will be found useful in understanding the following statistics and narration:—

Scotter village contains one hundred and eighty inhabited houses, eighty-six of which are connected with or close to the south sewer, and ninety-four have no connection with that sewer. The pneumonia incidence on the two groups of houses is most remarkable, the south sewer houses having had seventeen cases, while the ninety-four other houses have had only four cases. In other words, the houses near the south sewer have had one case in five, while the others have had one case in 23·5 houses only.

One case to five houses is the proportion in the whole number of the south sewer houses, but the forty houses on the east side of the main street—those nearest the sewer—have had eleven cases, or one in every 3·6 houses. Fieldston's case is reckoned as occurring on "The Sands," but it is highly probable that the disease was contracted at his old residence, perhaps during the "flitting," when he would be exposed much more than usual to emanations from the untrapped inlet just opposite his door. This is the inlet which is believed to have infected several persons. It will be referred to presently as standing fully ten feet higher than the highest inlet of one of the west side branches. Fieldston was again exposed to emanations from the open inlet the day before his attack, at the time of Barker's funeral.

If his case be reckoned as belonging to his old residence on "The Green," the case would stand thus:—

Eighty-six south sewer houses, had eighteen cases, or one in

4·7 houses ; forty houses nearest the sewer had twelve cases, or one in 3·3 houses. Ninety-four other houses had three cases, or one in 31·3 houses. Whether Fieldston's case be counted as belonging to these houses near the sewer or not is of little consequence ; without his case, the figures are exceedingly startling, and compel one to believe that there was a cause for the disease common to these houses, but almost absent from the other group. The only material difference in the surroundings of the two groups is in their sewerage (*see* Drainage of Scotter).

Let us now disregard the later cases and examine closely those of 1890. The eighty-six south sewer houses had twelve cases :—about one in seven houses. The ninety-four other houses had four cases :—one in 23·5 houses.

Analysing the eighty-six group, we find that forty east side houses had ten cases :—one in four houses. Twenty-six west side houses had two case :—one in thirteen houses. Twenty houses elsewhere situated had no case.

The escape of the twenty houses naturally suggests a difficulty to anyone who is not familiar with the actual state of things ; but, as will be shown presently, it forms an exceedingly strong link in the chain of evidence against the south sewer system. The reasons why the disease made special attack on the forty houses on the east side of the main street are as follows :—

(*a*) The main sewer runs close by these houses, being within three yards of most of them, while the width of the road divides it from those on the west side.

The twenty houses in the Messingham and Gainsborough roads and elsewhere are, with a few exceptions, not connected with the main sewer, but with comparatively little used branches ; and several are not connected with any sewer, but are counted as belonging to this sewer system, because they are near these branches.

(*b*) The houses on the east side (forty) are more numerous than those on the opposite side (twenty-six). Moreover, they are mostly in continuous rows without space intervening, while those opposite are more detached from each other. The inlets at the back of the forty houses are often close to the doors, more or less surrounded by walls, so that currents of air entering the houses had to pass over the untrapped inlets.

(*c*). The houses close to the main sewer stand for the most part on higher ground than those on the west side of the road ; and it is specially significant that they are actually on higher ground than the highest points of the two branch sewers whose houses escaped pneumonia, while the one branch whose houses did not escape is just that one which comes off from the main sewer, on the east side, at "The Green," and whose highest point is six feet higher than any part of the Gainsborough Road branch sewer, and fully ten feet higher than any part of the other western branch of the south sewer.

Now it is the nature of warm air, such as these sewers would contain, to rise to the highest outlets near at hand, hence the sewer air would, in the natural course of things, escape at the inlets on the east side rather than at those on the west, and at the large 9-inch branch on the east side at "The Green," rather than at the low-lying branches on the west side. I now come to the point which goes far to prove the above explanation to be the correct one. The five cases of pneumonia which occurred in Scotter, in March, 1891, were all in the eighty-six south sewer houses, but three of them were in the two roads which entirely escaped in 1890, where the two west side branch sewers are. The explanation of this is evident:—at the time of the 1890 epidemic, the houses on the east side of the main street were under double fire, that is, from the empty masons' traps in front, and the unprotected inlets at the back; but in June, 1890, the old rain water inlets were torn up in the main street and gullies put down instead; about the same time, the inlets at the rear of the houses were also provided with gullies, until, I believe, only one yard was left on this side of the main street unprovided, except in one or two instances, where the occupiers had voluntarily cut themselves entirely off from the sewer. But the twenty houses I have referred to as having escaped pneumonia in 1890 had few alterations made in their inlets. The result was soon evident. In the autumn of 1890, many cases of vomiting and diarrhœa occurred in both these roads, some that I attended being characteristic, one especially so was at a house in the Gainsborough Road: the mother and all her children were suddenly prostrated with violent diarrhœa and vomiting, the mother being in great danger for a time. Just opposite the back door was a large catchpit with a naked sewer pipe near the top to carry away overflow. The whole was surrounded on three sides by walls so that the sewer ventilated towards the house door, hence the attacks of the mother and children, the father being away all day about his work. The reason why they were all attacked about the same time was this—rain had just fallen in considerable quantity, and as no ventilation existed for the main sewer in place of the masons' inlets and numerous open inlets previously acting as ventilators, the rush of rain-water entering the main sewer drove sewer air up these branch pipes, where there was less pressure on account of the inlets there being still open for its escape. But with the new year of 1891, when the snows of January had melted in February, the latter month being entirely without rain, there came the natural season of pneumonia, and so, instead of the diarrhœa of the autumn, pneumonia made its appearance early in March in these twenty houses; in the meantime, however, several of them had been secured, those, for instance, where diarrhœa had occurred. The pneumonia, therefore, picked out those houses where the inlets had not been secured, doing this the more certainly inasmuch as outlets for escape of sewer air were now becoming fewer, and there was no other means of ventilation. Three cases occurred in these twenty houses where there were none in 1890, and I think it will be granted that the reasons I have given for the non-occurrence of cases in 1890, and their occurrence in 1891, are sound ones; they are borne out entirely by subsequent events; for during the influenza epidemic of this year an adult case of pneumonia occurred in these twenty houses; and while writing this history I have been attending two other cases in them, one actually being in a child who had pneumonia in March, 1891.

Thus these twenty houses have had six distinct attacks in 1891, equaling one case in every 3·3 houses, and this brings them to an exact equality with the forty houses where the disease made such havoc in 1890.

The two remaining cases occurring early in March, 1891, were at the southern or higher end of the main street. The sanitary surroundings of both houses were bad, and at one they were so bad, both inside and out, that a short description is necessary. The roof of the house permitted rain to pour through it and the bedroom floor into the living room, and there stand in pools; the floor of the house was in a marked condition of ordure, and in some parts was unpaved, indeed where the food was stored the floor was of naked earth; the back door frame was loose, and part of the wall knocked in; through the hole thus made rain-water from the unspouted eaves ran in freely. Through the door was the back-yard, closed in almost entirely by buildings, except on the right-hand, where the privy stood, with its door looking to the house. It had no pit, and the outlet was entirely covered by about a ton of ashes and other refuse. The inlet to the sewer was in front of another house, in the same yard, standing back to back with this one; it is that referred to as the only one left on the east side of the main street with a loose D trap. Rain had fallen just before the infant was taken with pneumonia, and it may be supposed that lying in its cradle amidst such surroundings it would get a full share of mephitic air driven from the soil by the rain.

It will have been gathered from what has been said about the drainage of Scotter, that the sewer inlets are almost always out of doors, though usually within a few feet of the back doors, that is, of the doors in most frequent use. In April, 1890, there were, however, three houses in the village with insufficiently protected sewer inlets indoors. One was at a house opposite the school, standing on high ground (fully fifty feet altitude). A carpenter and his daughter lived in the house. The inlet was in the shop, a building continuous with the living house, and was of the usual loose D trap kind. During the week ending April 19th, the father had been at work in his shop, but had not felt quite well. On the Saturday night, the shop was locked up, and remained closed till Monday morning, April 21st, when he went to collect his tools, and then started off for Waddingham, eight miles from Scotter. Arrived there, he worked Monday afternoon, all Tuesday and Wednesday, but Thursday morning was so ill that he could not finish what little work was left to do. He was dizzy, sick, had pain in the head, and was very cold ; but most noticeable was the intense drowsiness and apathy, this was so great that the driver of the cart which brought him back to Scotter could get no directions as to the right road. Arrived home, he was got to bed with difficulty, and died April 29th. Assuming that he began to be ill on the night of the 23rd, and that he received the infection on the morning of the 21st, when he went into the shop for his tools, the air of the shop being tainted through having been shut up for two nights and a day, the incubation period must have been at least sixty hours. Of course it may have been longer. His daughter suffered from intense pallor. After her father's death she left Scotter, and died shortly of hœmorrhage. At another house connected with the south sewer, having an unprotected inlet indoors (untrapped, in a coalhouse, close upon living room), a man died in 1887, after one or more day's illness, of acute congestion of the lungs ; that is, he died before pneumonia had time to declare itself. All the subsequent tenants, up to 1890, were more or less seriously ill, with throat diseases, intense pallor, &c. The house was untenanted at the time of the 1890 epidemic, but when it was over in Scotter a lady went to live there, and within a month was seized with severe erysipelas of knee, with abscess. Only one other house, so far as I know, had an insufficiently protected inlet to this sewer indoors. No pneumonia has been attended there in recent years, but the last tenant died of it, and much anæmia similar to that from which the carpenter's daughter suffered has been present in the house for a long time. The house stands on the west side of the main street, on ground several feet lower than the inlets of the houses opposite on the east side. The inlet has been far better cared for than either of the others was; the D trap fits well, is kept sealed with water, and chlorinated lime is often used.

Deficient Rainfall.—The whole of the facts already narrated point unmistakably to the south sewer as the chief cause of the epidemic in Scotter. Confirmatory evidence, almost equally striking, must now be detailed.

It has been said that the early months of 1890 were unusually dry, the rainfall being especially deficient in February, March, and April. No record of rainfall is kept at Scotter, but through the courtesy of Dr. Parsons, of the Local Government Board, and Dr. Moxon, Medical Officer of Health of the Brigg Rural Sanitary Authority, I am able to produce the following records of rainfall at Brigg, eight miles north-east of Scotter:—

The average annual rainfall at Brigg is 26·74 inches. This gives an average monthly fall of 2·22 inches, but the average of the spring months would be higher.

The rainfall at Scotter, it is certain, corresponded very closely with that at Brigg. The absence of rain in April was a subject of general comment. I have obtained records for the same period from Stockwith, south-west, and Bull Hassocks, due west of Scotter, and they are in essential agreement with those of Brigg on the north-east, and Lincoln on the south-east. All these records from places around agree in showing that for ninety-two days, extending from February 1st to May 3rd, the rainfall was less than half the average; and that for at least forty-one days (March 24th to May 3rd inclusive), there was actually only a trifle over *one-fifth* of the average rainfall. The largest fall at Brigg, in April, was ·15 inch, on the 25th. On May 4th, rain began to fall, in slight showers at first, but on the 7th, a fair rain of ·30 inch fell at Brigg, and on the 10th and 11th, there came a heavy rain of over an inch. In the eight days from May 4th to 11th, there fell 1·71 inch, nearly three times as much as had fallen in the previous forty-one days, and nearly four times as much as fell in the whole month of April.

DAILY RAIN-FALL AT BRIGG,

January to June, 1890.

Month and Day.	January.	February.	March.	April.	May.	June.
1	—	—	·03	—	—	—
2	—	—	—	—	—	—
3	—	—	—	—	—	—
4	·03	·04	—	—	·16	—
5	·05	—	—	·03		·21
6	—	—	—	·13	·10	—
7	—	—	—		·30	—
8	—	—	—	·01	·11	·11
9	·25	—	·25	·02	·16	—
10		—	·01	—	·72	·29
11	—	—	—	—	·16	·25
12	—	—	—	—	—	·18
13	·01	—	·03	—	—	—
14	—	·62	—	—	·01	—
15	—		—	—	·04	—
16	—	—	·05	—	·17	·12
17	·02	—	—	·02	·08	—
18	—	—	·03	—	·27	—
19	—	—	·81	—	·18	—
20	—	·05	·06	—	—	—
21	·20	—	·01	·07	—	—
22	·48	—	·04		—	—
23	·14	—	·25	—	—	—
24	·05	—	—	·03	—	—
25	·47	—	—	·15	—	·34
26		—	—	—	—	·03
27	·06	·13	—	—	—	·04
28	·27	·14	—	—	—	—
29		—	·19	—	·28	—
30	·12	—	—	—	·16	·74
31	—	—	—	—		—
Total	2·15	0·98	1·76	0·46	2·90	2·31

The epidemic began on April 6th, when there had already been over two months with about half the usual rainfall, and the drought continued with much greater severity for another month. It was during this month, from April 6th to May 8th, that the epidemic arose, accomplished its terrible task, and came to an almost abrupt close at Scotter. By the latter date, my father and I were well aware of the part played by the sewer, and when the heavy rain came, I paid a visit to the sewer outlet, at 8 a.m., on Sunday, May 11th, and found the river much swollen. Rain-water, black and nauseous with sewage, was pouring out of the pipe with great force and volume. Rain was then falling, and continued to do so for some little time. In the afternoon, I again visited the outfall, but found the pipe entirely submerged, the river having risen one or two feet between my visits.

This heavy rain cleared the solid matter out of the main sewer, and in this way, I think, put a stop to the epidemic in Scotter.

Three cases only occurred in Scotter village after this rain. The first was that of a hardy old woman, F. Hutson, aged eighty-two, the last of the old women of eighty and over, left alive in the forty east side houses; she lived in one of a row of small cottages south of the Green. On the evening of Monday, the 12th, she was suddenly stricken ill. Two inlets existed near her house, one near her front door, another a few yards from her back door; the latter was entirely untrapped, and its six-inch pipes ran directly into the main sewer, and were very liable to become choked. F. H. was very fond of having her doors open, and there is little doubt that as soon as the rain ceased on Sunday, May 11th, she would throw them open; indeed, it is not improbable, there being no wind, that she had them open during the rain. Now, when the rain abated, the sewer outfall, as already explained, was entirely covered by the waters of the swollen river, consequently gas could no longer escape there, nor could it escape freely at the masons' inlets, for they would be full of water; it would therefore be driven out at the untrapped inlets in considerable volumes, for a large quantity of rain-water was then entering the sewer and exerting great force on account of the good fall. Sewer air would thus be driven out of the inlet near F. H.'s back door, and if she contracted the disease at this time, as I believe she did, the incubation period would be from twenty-four to forty-eight hours.

The second attack in Scotter village after the rains was in J N., on June 8th. A few days previously, the sewer just in front of his only door had been opened to put down a gully-trap, as his neighbour, Mrs. Foster, had died of the disease about six weeks before. It is, I think, highly probable that he contracted the disease while the soil and sewer were being disturbed.

The third and last case was that of G. V., aged fifty, who was taken ill on June 21st. He lived, like the two preceding victims, on the east side of the sewer, and his house is the one nearest Scotton, where he went to work daily. He may have contracted the disease at Scotton. There is, however, another not improbable explanation. The south sewer began near his yard gate in a blind pipe, but did not connect with his yard. From this beginning to the first street rain-water inlet is perhaps twenty yards; these pipes, therefore, formed a *cul-de-sac*, or blind end, into which no rain-water could enter except from an inlet in his neighbour's yard, the pipes of which joined the sewer near the street inlet. This inlet in his neighbour's yard, the highest in the village, being nearly forty feet higher than the sewer outfall, was near G. V.'s pigsty, just beyond a broken-down wall. A loose D trap fitted into it, and, owing to its situation, very little rain-water could enter, and its pipes required to be taken up frequently to be emptied of sediment. Soon after G. V.'s illness, the beginning of the sewer was carried on into his yard, and the pipes forming the *cul-de-sac* were found choked with sediment. The inlet in his neighbour's yard is that already referred to as the only one on the east side o the main street left insecure in March, 1891.

The evidence as to the part played by deficient rainfall affords signal confirmation to that already narrated, and nothing appears wanting in the chain of evidence connecting this Scotter epidemic with sewer emanations. The terrible and explosive nature of the outbreak was due to accidental conditions of weather and season acting through a sewer which, on account of its good fall, was specially adapted for distribution of pent-up air to the householders it served.

These considerations also afford a satisfactory explanation of the subsequent slower and more persistent course of the epidemic at Messingham, where the sewers do not possess the advantages of fall and unimpeded outlet which the Scotter south sewer does, and where, moreover, they inter-communicate freely.

The same tale has to be repeated in connection with the mild epidemic of March, 1891. The first case was on March 3rd, and the last on March 19th.

The following is the rainfall as recorded at Bull Hassocks, ten miles due west of Scotter, for which I am indebted to Mr. Trethewey.

RAINFALL AT BULL HASSOCKS' ENGINE.

Month.		Total Depth.		Greatest Fall in 24 hours.
December, 1890	...	0·55	...	·18 on the 4th.
January, 1891	...	1·15	...	·28 on the 20th.
February	...	0·12	...	·04 on the 22nd.
March	...	1·33	...	·36 on the 7th.

The rainfall for three months preceding the outbreak of pneumonia in March was actually less than the average fall of one month. The rainfall at Scotter in February was practically *nil*, as it was at Bull Hassocks. Concerning this, Mr. Trethewey writes :—" The entire of what is put down as rainfall for February I believe was from heavy mist, which was more or less through the month."

Children's Epidemic.—A few words must be said respecting the cause of the children's mild, but widely prevailing sickness. I may premise first that there was nothing absolutely new in this accompanying sickness. Many other well-known outbreaks of pneumonia have been accompanied by similar gastro-intestinal and throat disorders. I cannot of course say whether the evanescent sickness amongst children at this time was really the same disease as manifested itself as lung inflammation in adults or not; but I am confident that it was conveyed to the children through the same medium,—emanations from the south sewer, or other unhealthy surroundings of the school. That the sickness was not catching or capable of immediately producing pneumonia in healthy persons is shown conclusively by a very simple consideration. The illness was equally prevalent amongst school children all over the parish, few, if any, families entirely escaping it, though it was so evanescent that the majority never ceased attendance at school; yet, in spite of its widespread distribution, the parents of the children did not suffer in the same way to any extent, nor did they contract pneumonia through being exposed to their children sick with this mild illness. It has been seen distinctly and positively that it was only those adults in Scotter who were exposed day by day to emanations from the south sewer, who contracted pneumonia, all others escaping, except two who lived in grossly insanitary houses. Practically, therefore, the children's sickness was distinct from the pneumonia, though evidently conveyed in the same way.

Now the school children were the only section of the village community, who as a body, were constantly exposed to sewer emanations. In the intervals of school hours they habitually played in the street near the school, and especially near one particular rainwater inlet, the street in front and below the school being their ordinary playground; in this way all would be more or less exposed to the rain-water inlets of the south sewer just at a time when they contained no water, and, therefore, were acting as ventilators of that sewer. The close proximity of the privies to the school, their closed-in condition and unpaved entrances, as well as the accumulation of ashes and refuse lying on the school wall and under its windows, doubtless were not without influence in the same direction. I am not aware that cases were seen in children after rain fell early in May. The rain would fill the masons' inlets and thus stop them acting as ventilators, and a few days later there came heavy and continous rain.

CONTAMINATED FOOD AND AIR.—The conditions of life in a village are so simple and so well within the personal knowledge of any observant inhabitant, that it is far easier to investigate all the circumstances of such an epidemic as this, than in the case of a large town where the conditions of life are infinitely more varied. It is on this account that the history I am relating is so significant. The influence of different causative agents can be more easily apportioned to their proper sources.

At Middlesbrough, Dr. Ballard was able, after infinite labour and research, to settle beyond reasonable doubt, that the bacon consumed in that town was one cause of the prevalent pneumonia. The bacon was manufactured in the town from salted pork. After excess of salt had been washed away in vats, the meat was hung up to dry in sheds or yards, the air of which was more or less contaminated by sewer air and products. Now it appears that of all meat, that of the pig is most liable to absorb and retain disease germs, and instances in which its consumption has been followed by serious and even fatal results are becoming numerous, that at Welbeck Abbey being best known in this neighbourhood.

Mice fed on bacon manufactured at Middlesbrough were found to die of the same disease as other mice fed with the phlegm of pneumonia patients; and it was shown that amongst certain classes who were accustomed to eat their bacon almost raw—simply warmed through on a fork—cases of pneumonia were most numerous on Saturdays, Sundays, and Mondays.

At Scotter, however, it is certain that this was not a common cause, and it is doubtful whether any case was so produced; the absence of many multiple cases points strongly to absence of food contamination. The following reasons may be given for the belief that bacon had little or no part in the Scotter epidemic:—

(*a*) Bacon as manufactured at Middlesbrough is not consumed at Scotter.

(*b*) Most of the bacon used is home fed, and being cured indoors, where there are no sewer inlets, is not likely to become infected.

(*c*) Bacon is rarely eaten half raw.

(*d*) The epidemic at Scotter was dependent on other well-known conditions, and when those conditions were temporarily removed, the epidemic ceased. If bacon had been a causal factor, cases would have continued to arise therefrom, for the Scotter people attached no suspicion to it.

It was very unlikely that bacon should be a cause of the disease at Scotter, as it always receives thorough cooking before consumption; and the pneumonia germ is destroyed by a heat considerably below that of boiling water. There is, however, the possibility that food already cooked might become contaminated, and so cause the disease; but, if this occurred, there would be two or more cases in the same house near together in time. Now multiple cases were entirely wanting at Messingham, and Scotter parish only afforded one instance, viz., that of the little girl, the only scholar who contracted pneumonia, whose father fell ill ten days afterwards. The child was ill a week or so, and during that time was nursed in the kitchen in the day-time, nursing and preparation of food going on simultaneously. The father was more likely to be infected in this way through food than by contagion, for he did little nursing, being at work all day, and not sleeping in the same room. At the same time he was going almost daily into Scotter, just at the most acutely epidemic period; so that there are three possible methods by which he may have taken the disease, and I must leave the reader to judge for himself which was the most probable. I know of no other case in which there seemed any probability that food was the medium by which the disease was conveyed from person to person.

Contaminated Air.—I am not here dealing with sewer air, or with air polluted by emanations from surface filth, but with air contaminated by dried excretions derived from the patient, especially dried phlegm and solid matters from the bowels. There is excellent reason for believing that this danger is as real as in the kindred disease, typhoid fever; fortunately, however, prevention is far easier in pneumonia than in that disease. Were this not so pneumonia would be seen in multiple cases far more frequently than it is. The difference in this matter lies in the particular excretion conveying the disease. In pneumonia, the specific germ lies chiefly in the phlegm; and measures such as cleanly people generally take suffice to prevent its spread, while in typhoid fever much more stringent steps are necessary, because the poison lies in the matters derived from the bowels. Where ordinary cleanliness is observed the chief danger of pneumonia lies in pocket handkerchiefs. In many families of tidy and cleanly habits it is, nevertheless, a common practice for the members to borrow handkerchiefs from one another. Now in the case of a pneumonia patient, this practice would be fraught with peculiar danger. The phlegm coughed up by such patients is full of pneumonic germs; the handkerchief soon becomes dry, and if a relative has taken one to wipe away the patient's expectoration, and afterwards uses it, dried particles are very likely to be drawn into the lungs. This doubtless is one explanation of those instances in which near relatives acting as nurses have taken pneumonia in succession, and it is just possible from what I can remember, that the case mentioned above under "Food Contamination" was thus produced.

The only case whose history lends any support to the belief that the disease may be contracted through breathing air laden with solid particles derived from the bowels, is that of my father. The condition described by him as existing at the house where he believed he contracted pneumonia was simply terrible. A room no larger than a closet, and incapable of efficient ventilation; a patient, helpless and afflicted with uncontrollable diarrhœa; the bed saturated, and skilled nursing entirely absent: one does not wonder that he was nauseated, and believed that it was the polluted atmosphere which caused his illness. But here, too, there are several confusing elements: chief amongst them is the fact that in his rounds my father was daily exposed to sewer emanations at this and many other houses, and on the day before his seizure there was a sharp shower of rain (*see* rainfall at Brigg, on May 7th), which would close the street inlets, but drive sewer air out at the back inlets. There is also the possibility that he contracted the disease while working in his garden near the outfall, as he had often noticed a smell after such rains. It is almost certain that my father contracted the disease in one of the ways above indicated—which was the real one cannot be asserted.

Contagion.—It will be proper to say something about the incubation period of the pneumonia. Two cases have been narrated (E. C., and F. Hutson) in which the interval between exposure to the cause of the disease and its onset was sixty and twenty-four to forty-eight hours respectively; these periods, however, were only highly probable, by no means positively certain. Another case of a similar character was that of my brother, who lived above a mile out of Scotter. He was taken ill at 5 a.m. May 19th: he had not seen my father, who was then ill of the disease, nor had he been near the sick room, or taken food in the sick house. At 7.30 p.m. on May 18th, however, he and a brother, while walking down the main street near where cesspools and many untrapped branch inlets into the south sewer then existed, were nauseated by a particularly foul smell, a considerable shower of rain having just fallen. This exposure to sewer air was about nine or ten hours before his attack, but it cannot be confidently asserted that it was the real cause, for there was some probability that he had previously been exposed to like emanations. Nevertheless, it is the general opinion that the incubation period is very short—a few hours to a few days—and this agrees with the experience of other epidemics; indeed, it has been said that there is frequently no incubation period properly so called, the patient falling ill very soon after exposure. The experiments with mice are of value, for they show that the incubation period in those animals was eight hours in some, twenty-four to forty-eight hours in others, the period being about the same in different mice fed from the same patient.

The points in favour of contagion are as follows:—

(*a*) Certain nurses, while engaged with the sick, fell ill of the disease.

(*b*) Two medical men, who attended some of the cases, contracted the disease.

(*c*) At certain houses, more than one case of pneumonia occurred in each.

Nurses.—The evidence in favour of contagion rests almost entirely upon certain cases in nurses occurring at Scotter during the height of the epidemic, when other cases not admitting of such an explanation were most common.

Dividing the thirty-four 1890 cases into two groups, we find that twelve of them occurred in the month of April, and twenty-two in May and following months. Late in the epidemic, I found that the twenty-two patients, whom at that time I had attended, had had seventy-two nurses, and I drew up a list of their names; unfortunately it is not now in my possession. These seventy-two nurses, of course, included some who only took charge of the patient for a single night while others took rest. It will be fair, therefore, to assume that the twenty-two pneumonia patients, attacked on and after May 1st, had seventy-two nurses between them. *Not one of these nurses contracted the disease.*

I cannot state the number of nurses engaged with the twelve April cases, but should think the proportion would be about the same; one or two had as many as six nurses each. Three nurses contracted pneumonia during, or shortly after, attending the April patients, and there were two others, who had been in attendance a fortnight before. Now there was one circumstance common to these five cases, viz.:—all either lived in the forty houses on the east side of the sewer, or nursed patients living there; that is, no nurse contracted pneumonia who was not exposed to the south sewer at its most dangerous points; and the most significant fact of all is this: the proportion of all attacks amongst the nurses in attendance on the twelve April cases was the same as amongst the seventy-seven adults, living on the east side of the south sewer, at the outbreak of the epidemic. In other words, the adult inhabitants of these forty houses were in as great danger as the nurses of the twelve persons ill during the most virulently epidemic period. The adult inhabitants numbered seventy-seven, and they had ten cases, including Fieldston, that is 12·98 per cent. The nurses of the twelve April cases numbered thirty-nine (assuming them to have the same proportion of nurses as I found my early twenty-two cases had), and they had five immediate and remote attacks, or 12·82 per cent.

Rejecting Fieldston (because his illness, though doubtless contracted at his old residence, occurred elsewhere) we find that the seventy-five adult inhabitants of these houses had nine cases, or 12 per cent. Including the only multiple case, that of Jackson, amongst the nurses—though he did little nursing, being at work all day and sleeping in another room at night—the percentage of immediate and remote attacks in April would be 15·3. Comparing the incidence of the pneumonia on all the 1890 nurses with its incidence on the seventy-seven adults living on the east side of the south sewer, we find that 111 nurses (the computed number, and including Jackson as a nurse) had six attacks, or 5·4 per cent., while the adults resident in the forty houses at the beginning of the epidemic had ten cases, or 12·98 per cent., more than twice the percentage of the nurses.

The above facts are exceedingly significant, and were it not that some of the particulars are most instructive, would render it unnecessary to enter into details; indeed, it is almost impossible to escape the conclusion that the cases among the early nurses were due to the same cause as that producing the cases they nursed.

The three nurses who fell ill whilst engaged in nursing pneumonia patients, or immediately afterwards, were Mrs. Vickers, Mrs. Foster, and Mr. H. Chantry. Mrs. Vickers assisted in nursing Mr. James Barker, the first victim, who is believed to have contracted his pneumonia at the inlet near his back door, as well as his neighbour Fieldston, and Mrs. Chantry, the last being engaged in cleaning and flitting at Barker's house, between a week and a fortnight after his death. Mrs. Vickers had sat up one night with Barker, and assisted in laying him out; and it is specially important that on the morning of April 11th she was engaged with washing, which would necessitate her going to the untrapped inlet of the sewer to empty soapsuds, and these would force out an equal volume of sewer air under her nose. It is most interesting to note that of all the persons who nursed Barker during his illness (he had many nurses and visitors, probably ten), it was just those two who did washing, one directly after the death, and the other thirteen days after, who contracted the disease. Now, as it is highly probable that no less than four persons, viz.:—Barker, Mrs. Vickers, Fieldston, and Mrs. Chantry, contracted pneumonia at this inlet, it becomes important to know why it was thus specially dangerous. The reasons appear to be these:—

(i) The inlet at Barker's was on high ground, being six feet above the highest inlet of one other branch of the south sewer, ten feet above the third branch, sixteen feet above the main sewer, near the bridge over the Eau, and probably over twenty feet above the outfall pipe.

(ii) Being a naked pipe, without trap, it probably acted as a ventilating shaft to the sewer.

(iii) It was just underneath the pump, consequently exposure to its emanations would be very frequent.

(iv) The pipes were nine and six-inch sizes, much too large to serve six small cottages.

(v) The nine-inch pipes were found half full, and the six-inch pipes almost quite full, of foul black sediment, after the heavy rain of May 10th.

The disease began in these houses, and it is possible that the poison was first generated in this branch sewer; for here existed every condition requisite, not only for serving sewer air through this convenient outlet, but for the raising and breeding of disease germs in the pultaceous mass within the sewer. Just before the close of the epidemic, a portion of Barker's branch was cut off from the main sewer, some of the pipes being torn up, and the remainder were secured by gully traps. No case of pneumonia has occurred there since.

Mrs. Foster went three or four times to visit her sick son-in-law, and gave a little assistance in nursing on one of these occasions, but this was very limited, as she had much work at her own home, where there was an inlet to the sewer exactly opposite, and only a few feet from her door.

The third case, that of Mr. H. Chantry, is the only one in which there is any likelihood of contagion having been the cause of illness. Chantry lived at Susworth, where he had recently had scarlatina and diphtheria, and he came on three successive nights to nurse his mother in Scotter; thus he was far more exposed to any possible contagion than were the other two, but it must be kept in mind that he was also exposed to emanations from the sewer just at a time when the drought was worst, the inlets near his mother's back door having only loose D-traps, and the rain-water inlet, a few yards below the front door, being then entirely open; moreover, he was exposed to danger from contaminated food, so that it is impossible to regard his case as positively due to contagion. All that can be said is, that it may have been thus caused; in the light thrown upon the matter by the whole history of the epidemic, it certainly cannot be said that contagion was the most probable cause of his illness.

In the case of the two other nurses who were taken ill—one fourteen days, and the other sixteen days after assisting in nursing patients, the length of time almost precludes contagion; and both cases have been already alluded to (Mrs. Chantry and Mrs. Fanny Hutson) as being markedly under the influence of the south sewer a few hours before their attacks.

Fieldston never visited his neighbour Barker, nor saw him after death, but assisted at the funeral to carry him to the grave, spending only a few minutes in the house, and taking no food.

In no other instance was the slightest evidence of contagion obtained except in such as have already been narrated; and the absence of all history of contagion was especially marked in the earliest cases in each village. The entire escape of the later nurses can only be ascribed to the fact that, early in May, the sewers came under suspicion, and precautions of various kinds were used, carbolic acid and perchloride of mercury being emptied down inlets where danger seemed greatest. In these later cases, when questioned as to precautions, I simply directed attention to the sputa, and assured nurses that, provided they destroyed the sputa, washed their hands before eating, and were careful to have the sewer inlets put right, they stood in little or no danger of taking the disease. The escape of the nurses was certainly not due to precautions against contagion, for contact with the patients was of the closest, a considerable proportion of nurses sleeping in the same bed with the patients, many even through the entire illness. Visitors, too, were very numerous; four, and even six, have been found sitting around a patient's bed at once.

In no case did any new inhabitant of the numerous houses vacated by death contract pneumonia, notwithstanding that, as a rule, such houses were only cleaned in the usual May-day fashion. Gully traps, however, were fitted into the sewer inlets.

TWO MEDICAL PRACTITIONERS CONTRACTED THE DISEASE.—The case of my father has already been discussed, under the head of "Contaminated Food and Air." The second victim was the late Mr. W., aged thirty, who was taken ill while attending a case of pneumonia at Messingham. Mr. W. lived seven miles away, and as his patient was seriously ill, frequently stayed many hours, taking food in the house.

So far, the history points partly to contagion, and such it may have been, but there is strong reason for thinking otherwise. The block of three houses of which his patient's formed one, has of late years had much sickness, chiefly of the nature of diarrhœa, and sore throats of a diphtheritic nature in children and erysipelatous in adults, and several cases of throat mischief had occurred shortly before pneumonia broke out. The houses and buildings form three sides of a square, the privies of two of them being within the square. The back yards of the two cottages are especially insanitary, and both communicate with the yard of the house where pneumonia occurred. In one of these small communicating court-yards, exactly opposite the house door where pneumonia occurred, and about twenty yards distant, was a cesspool closed in by walls on almost all sides. Into this cesspool there were three openings besides the upper cover, one taking house slops from a D-trapped inlet one or two feet distant, a second receiving excrement from a privy standing close upon the cesspool, and a third, a naked outlet pipe, taking liquid overflow by a good fall into the general sewer system. The cesspool was covered with wood, but was unventilated, and through the privy seat the three yards were in distinct aërial communication with the public sewers. The privy manure, of course, did not escape into the sewer, but sank to the bottom of the cesspool, the upper liquid contents draining off. Close to this arrangement, and midway between it and the house-door referred to, but a little out of the direct line, was a second privy belonging to the second communicating yard. Its ash-pit is open to the rain, being entirely uncovered.

This condition of things had been pointed out, before the occurrence of pneumonia, as the probable cause of the prevalent sickness in these houses.

MULTIPLE CASES.—The epidemic of 1890, and those of the present year have only produced one instance of more than one case in a house at about the same time, viz.:—that of G. H. J. and his daughter, the latter being attacked while attending school, and the former falling sick ten days later. The circumstances have already been narrated under the head of "Contaminated Food and Air." The occurrence of multiple cases, though specially characteristic of contagious diseases such as measles and hooping cough, is more or less common to all fevers, and it is somewhat surprising, considering the ease with which food may be contaminated, that so few instances have been met with in these epidemics. Speaking of the occurrence of multiple cases in one house or family, Dr. Ballard says, "Such an event indeed is no evidence of communication of a given disease from the sick to the healthy, when standing alone as an exceptional occurrence; though it may have some significance in this direction when of frequent occurrence in the course of an epidemic. The reason for hesitating to accept infection from person to person in either of the above cases is that it might be that all persons attacked had been exposed to the influence of one and the same extraneous cause, living as they would have been under the same or similar conditions and surroundings." "The extraneous cause" to which G. H. J. and his daughter may have been exposed was of course sewer emanations at Scotter. This was the only multiple case during the epidemic periods, but it will be best to refer to certain other cases which have occurred with considerable intervals between the attacks.

In October, 1890, a child died at Scotton in the house where the little girl had pneumonia the previous May. The child was strong and healthy, but succumbed after being two days in convulsions. It also had bronchitis, and just before death I detected some evidence of pneumonia. There can be little doubt that contagion had no hand in its death, for its sister had been recovered four and a-half months, and a sufficient cause existed in the persistence of the gross conditions already described as existing in May. The same remarks apply with equal force to a third case in which, influenza having attacked all the members of the family, the infant died with pneumonia. This third case was in May, 1891, nearly twelve months after the first case, and about seven months after the second. The onset of pneumonia may have been a simple consequence of the influenza, or it may have been due to overcrowding and emanations from the unprotected sewer, which I believe were the effective cause of both the preceding cases.

An undoubted single case, one of the most extraordinary I have attended, occurred at Laughton, four miles south-west of Scotter, in September, 1890; and seven weeks before, in the same house, an old man had died rather suddenly, but in his case the existence of pneumonia was doubtful. At this house there was a foul pond of liquid and solid manure within a few feet of the door, and I was informed that the liquid sewage had at times to be carried away in buckets to prevent it entering the house.

The absence of numerous multiple cases at Scotter is of course due chiefly to the non-contagious nature of the disease, but in part also to absence of food contamination, and to the fact that there are fewer persons in each house (3·75 per house in Scotter) than in towns. It must, however, be kept in mind that other persons in the sick house may take the disease from the same source as the patient did; and it should ever be the first anxiety to find out and rectify any possible defect which may have been the causing factor. Recently I have attended a child living on the west side of the south sewer, whose mother had pneumonia sixteen months before; and in one of the March, 1891, cases a second child was ill, but its illness was transient and unaccompanied by definite lung signs.

METHOD OF EXTENSION OF THE PNEUMONIA TO NEIGHBOURING PLACES.

On May 3rd, pneumonia appeared at Scotton one mile from Scotter, and on the 31st, at Messingham, two miles distant. At each place it was evident that the disease was identical with the Scotter pneumonia, both on account of its characteristics, and its absence from more distant places in the sub-district. Subsequently this identity was proved by communicating the disease from a Scotton case to mice.

There appeared to be three methods, by one or more of which the disease might possibly be conveyed to neighbouring places.

(1). By contagion.

(2). By means of expectoration or other excreta of sick or convalescent persons gaining admission to the sewers.

(3). By means of winds conveying the poison from the south sewer at Scotter to the surface nuisances and sewer inlets of Scotton, Messingham, and other places.

With regard to the first method, it has already been said that no history of contagion could be obtained in the case of T. C.. of Scotton, or W. M., of Messingham. Considering the whole history of the epidemic, it may safely be assumed that contagion had no part in the introduction of the disease into Scotton, Messingham, or other neighbouring places.

So decided an opinion cannot be expressed as to the influence of soiled linen, and of expectoration, or other excretion of sick or convalescent persons; nevertheless, nothing has yet come to light to support this view. The effects of one deceased person were divided, one part going to Scotton and the other to Messingham; but the disease had already broken out at the former place, and the outbreak at Messingham was not in the particular neighbourhood to which the linen had been conveyed. It is evident that children had nothing to do with the extension, for they failed to convey the disease to the western parts of Scotter village, and their illness, with two exceptions, was not pneumonic, but of the character of sewer air poisoning; moreover, at that time children did not come to Scotter school from Scotton. Yet, it is possible that some means of this nature, whereby the poison was introduced into the surface filth and sewers of Scotton and Messingham, may have been overlooked.

The third method, however, seems most consistent with the facts of the case. It may appear improbable and contrary to what is known about some other diseases, that micro-organisms should resist the oxidising action of the atmosphere, and retain vitality after a journey of even a mile. On the other hand, however, there are diseases of the "fever" class whose germs it is well known can travel over wide tracts of country.

The autumn of 1889 and following winter were peculiarly favourable to low forms of life, and the winter was unusually mild. One phenomenon, showing the unusual nature of the season, came under my own observation early in the winter before influenza made its appearance. The clover hay had been gathered by the farmers of this neighbourhood, in very good condition, about June, 1889, there being no rainfall upon it; the meadow hay was got in almost equally fine order later on. In December, however, when the clover stacks were cut into, a foot or more of outside was found so full of mould, that the men were enveloped in clouds of whitish spore dust. The ordinary hay was not so bad, though more or less affected. This mould was not due to dampness, nor was it due to exposure of the stacks in bleak situations, for it was equally marked in stacks sheltered by buildings. The trussers, who were engaged trussing hay for sale, agreed that its extent was something out of common observation, and they attributed it to peculiarity of season. Now the fact that the outside part only of each stack was affected, shows, I think, that the cause lay in the atmosphere; that the mould spores were filtered from the air as it penetrated into the hay, and then grew. The hay in other parts of each stack was perfectly sound and sweet, contrary to what is found when dampness is the cause of mould. The disease attacked the stacks after they were built, and this, with the fact that all clover stacks suffered alike, shows that the atmosphere was the medium through which the mould was conveyed, and that the spores were widely distributed through that medium.

An eminent observer, Nägeli, has demonstrated that the micro-organisms of specific fevers, etc., are incapable of escaping into the atmosphere from moist surfaces. If this be so (and many medical men accept his conclusions), it affords a rational and satisfactory explanation of what was observed at Scotter—the continuance of the pneumonia during the dry weather, and its abrupt decline when the heavy rains of May

10th washed out the most part of the sewer. It has been seen that the branch with large pipes going to Barker's house was three-quarters full of fermented sediment; and it is known that the main sewer itself, previous to May 10th, also contained a good deal of deposit; and for at least forty-one days there had been no effectual rain. The result of the long-continued absence of rain would be this: the nine-inch pipes would contain a certain depth of sediment similar to that found in Barker's branch on May 16th, and that which entirely blocked the upper six-inch pipes of the main sewer the previous winter. The driblets of slops and other waste water constantly running into the pipes would soak the chief part of this mass, and keep it in a soft pultaceous condition; but here and there where paper and solid sewage stuck, islands would form, and these, becoming surface-dried by the constant up-draught of warm air, on its way to escape at the higher inlets, would present the exact conditions, which Nägeli says are needful for the escape of germs into the atmosphere. Who has not seen stale bread in a damp pantry, covered with a thick coat of delicate-structured mould? A breath of wind sends the spores in all directions. Somewhat similar to this perhaps, was the process going on in the south sewer, only it must be remembered that these disease germs are infinitely more minute and simple in structure, and are more readily retained in, and conveyed by, the atmosphere when they once gain admission to it. Now Dr. Klein has shown that the bacillus pneumoniæ, when cultivated artificially, comes to perfection in a little over a week, and that it thrives best when in close contact with air. In this sewer, therefore, were all necessary conditions for its cultivation :—abundance of semi-solid nutriment; a constant up-stream of air, the natural consequence of the good fall of the sewer; and no efficient flushing for fully forty-one days. The virulence and intensity of the pneumonia epidemic point to the conclusion that the poison was expelled from the sewer inlets in great abundance; and provided the germs have power to retain life in the outside atmosphere (and Dr. Klein's account of its characters lead one to suppose that it may have this power), its conveyance to neighbouring places would simply be a matter of direction of wind. The ability for mischief of germs thus conveyed, would depend entirely upon whether they met with suitable pabulum in the shape of surface filth and insanitary sewer inlets.

If this theory should be correct, it explains the order of attack of the villages around. North and north-east winds prevailed most about that time, therefore Scotton suffered first; but Messingham, lying northwards, is far more exposed, being on a spur of the cliff, and so might receive colonies of bacilli when the wind veered round to the south.

INFLUENZA AND PNEUMONIA.

THIS history would be incomplete without some notice of the influenza epidemics which preceded and followed the fatal pneumonia of 1890.

The order of events at Scotter, in connection with the two diseases, has been as follows:—

From Christmas, 1889, to the end of February, 1890, influenza was epidemic, but unaccompanied by pneumonia. Pneumonia broke out on April 6th, influenza then being absent from Scotter, but lingering in villages around. Then followed eight months without either disease; but early in March, 1891, five cases of pneumonia occurred in children, and a week or two later the second and more widespread epidemic of influenza appeared, accompanied by many cases of fatal pneumonia.

As an epidemic of characteristic type, influenza had previously been absent for a great many years, though our fathers had seen it in their early days, and our grandparents held it in wholesome dread. The earliest case seen by me was in November, 1889. The disease behaved in characteristic fashion—soon to become so familiar—attacking all the members of a large family except one, and leaving the usual train of after effects. It did not become general, however, for more than a month—after Christmas—and it was only in the first days of January, 1890, that it reached alarming proportions. After the third week of January it slowly declined. In Laughton parish it continued very prevalent through March, and some cases were seen in April. One remarkable instance of late attack, which occurred at Manton, is worth recording. A man, his wife, three daughters, and one son, left Scotter with their furniture on May 13th, and went to live in a lonely house standing on the summit of the Cliff hills, about 130 ft. above sea level, their old house at Scotter being at 25 ft. altitude. The house had been empty for some time, therefore was not infected by the influenzal poison; but it was exceedingly exposed, having no shelter, and overlooking a wide tract of high ground. In from two to four days after their arrival, all the family, except the father, fell sick with well-marked influenza. Brought from a sheltered to an exposed situation, they contracted the disease at once, though it had ceased to be epidemic in the neighbourhood. At this date pneumonia had been epidemic in Scotter more than a month. Outside the village, no case of pneumonia was seen in an adult until the disease spread to Scotton, and only one in a child; and there was only one death in an adult from pneumonia during the first six months of 1890 in the whole sub-district, excluding Scotter and Scotton. The population of the sub-district is 4,088, scattered throughout fourteen civil parishes.

The influenza epidemic of 1891 has been more general in most of the villages of this neighbourhood than the previous one was, and much pneumonia has accompanied it in and around Scotter. Several cases suspicious of influenza were noted about the middle of March; but the following are the dates on which the first undoubted cases were seen in the respective villages:—Blyton, March, 23rd; Northope, March 26th; Scotter, March 26th. Messingham was attacked a little earlier, the epidemic there being sharp, but soon at an end. At Scotter, however, the disease behaved differently. A few early cases were seen and some continued to occur while it was most prevalent around, but the epidemic seemed, as it were, to shoot over the village to Northorpe and Blyton; and, in May, when it was subsiding elsewhere, became distinctly epidemic in Scotter. What was the cause of this behaviour, I cannot say; possibly the peculiarly sheltered situation of Scotter was concerned, the villages that suffered most severely—Northorpe and Blyton—standing exposed to the prevalent north and east winds.

At Scotter the influenza reached its highest point in the third week of May. The number of cases, however, was not so great as in the villages just mentioned, and when uncomplicated they were of a milder type. Unfortunately many cases ran on to pneumonia either at once—the two poisons seeming to attack the victim simultaneously—or pneumonia developed some days after influenza, or even when the latter disease had subsided. In May, the death rate from pneumonia equalled 85·7 per thousand.

The following statistics are well worth attention, as they show in a marked way the liability of influenza to develop pneumonia when it occurs in a neighbourhood where the pneumonic poison is established, and form a striking contrast to the record of the influenza epidemic of 1889-90. The Scotter registration sub-district, comprising fourteen civil parishes and a population of four thousand and eighty-eight, had fourteen deaths from influenza in the three months, April, May, and June, 1891. Five of these deaths were due to bronchitis as well as influenza, and in the remaining nine cases pneumonia was the real cause of death. Most of the deaths from bronchitis were in remote parishes; but of the nine pneumonia cases, no less than six were in Scotter village, while three were in villages within four miles of Scotter. In other words, Scotter village, Scotton, Northorpe, and Laughton, with a population of 1,459, had nine deaths from pneumonia in the three months; while all the rest of the sub-district, with a population of 2,629 had no death from pneumonia complicating influenza, and only one death from pneumonia in any form. This incidence of pneumonia on Scotter was evidently not due to exposure to cold, for Scotter is far more sheltered than other places; nor was it due to exceptional severity of the influenza, for the cases when uncomplicated were milder at Scotter than in most other villages. The only conclusion that can be arrived at is that the pneumonia appearing at this time was identically the same as we have been dealing with in preceding pages; that the poison had become thoroughly endemic in Scotter—that is, lodged in the soil and sewers—and that these were cases of influenza in which the pneumonic poison entered the system with the influenzal poison, or afterwards when the vital powers were depressed by it. The pneumonia was not an inherent or natural accompaniment of influenza, but was due to something else added to it; that something else being either a distinct poison, or possibly a poison modified and fixed by transplantation to the sewers of Scotter.

Whether the same explanation holds good at other places throughout the country, where the influenza of 1891 has been accompanied by a far greater amount of pneumonia than was the case in 1889-90, I do not know. This view is entirely supported by the statistics of the neighbouring sub-district of Willingham, population, 3,525, for which I am indebted to my neighbour, Dr. Sutton. He informs me that there have been several deaths from influenza complicated by bronchitis, &c., during the three months of April, May, and June, but *not one death from pneumonia.* Influenza was quite as severe in the Willingham as in the Scotter sub-district, for Dr. Sutton informs me that he attended over one thousand cases, and many others were attended by other medical men. The Willingham sub-district, like the outlying parts of the Scotter sub-district, had not become infected with the pneumonic poison at the time of the 1891 influenza outbreak, hence the absence of pneumonia. How important then does it become to eradicate the poison from this neighbourhood before it spreads farther around !

FINAL STATISTICS.

WHILE the preceding pages have been in preparation, there has been a fourth outbreak of pneumonia in Scotter village. Five attacks have occurred in children, between July 28th and September 3rd, all recovering. These, with seven cases during the influenza epidemic and five in March, make seventeen cases occurring in Scotter village in the first nine months of 1891, one more than occurred in the fatal 1890 epidemic. Four only of these cases have been in adults, of whom three died, the majority (thirteen) being in children, of whom four died. All the fatal cases but one (a child) were associated with influenza; some of the fatal cases in children, being also associated with pleurisy.

Of these seventeen cases, twelve have occurred in the south sewer houses, and five in houses in other parts of the village. One of these latter houses, however, though just outside the area drained by the south sewer, has an inlet to that sewer belonging to another house opposite the door; and only a few yards away is one of the three street inlets into the south sewer, which still remain untrapped; so that this house was really under the influence of the south sewer. In the four remaining cases, the disease seemed to have made a discriminating selection amongst the ninety-four houses. In a word, all that has been written on this point respecting the 1890 pneumonia, applies with equal force to most of the seventeen cases of 1891.

During the eighteen months ending October 5th, 1891, there has been a total of thirty-three cases in Scotter village alone. These have occurred in thirty-one houses, there having been two attacks in one house, with an interval of sixteen months, and at another house a patient has had two distinct attacks with an interval of six months. This shows that during the last eighteen months pneumonia has invaded one house in every 5·8; has attacked one person in every twenty-one, and killed one in every forty-one. Of the thirty-three cases up to date, twenty-four have been in the south sewer houses and nine (including several believed to have been contracted away from their own homes) amongst the ninety-four houses in other parts of the village. This gives one case in every 3·5 for the former houses and one in every 10.4 for the latter. Of twelve cases occurring in the south sewer houses in 1891, six have been in the twenty houses which escaped pneumonia in 1890, where insecure inlets are now most numerous.

SUMMARY OF CONCLUSIONS ARRIVED AT.

THE following is a summary of the conclusions which seem to be justified by the history of the disease in Scotter :—

(1) The pneumonia seen at Scotter during the last eighteen months is a "fever"; that is, one of the specific febrile diseases.

(2) It is not a new disease, but has increased in prevalence during the last ten years: a well-marked epidemic occurred in the spring of 1886.

(3) It has been caused by emanations from foul sewers and soils.

(4) The soil, and especially the sewers of Scotter, have become infected in almost all parts of the village, and have thus become breeding grounds of the disease germ.

(5) The virulent and fatal epidemic of 1890 originated through the disease germ breeding in the large south sewer.

(6) The special virulence of that epidemic was due to many assisting factors, chief amongst which probably were these :—

(*a*) The prolonged dry weather, more particularly in the month of April, spring being the natural season of the disease.

(*b*) The good fall of the sewer causing a constant up-draught from the outfall to the untrapped inlets, and especially the higher inlets. For the same reason, too, in the absence of efficient rains, the liquid portion of the contents drained away, leaving the sediment to ferment and become surface-dried.

(*c*) The season appeared to be specially favourable to the growth of low forms of life, such as moulds, mildews, &c.

(7) During the prevalence of the 1890 epidemic, the disease may, in a few cases, have been caused secondarily apart from sewer and filth emanations. That it may be thus caused is all but proved by the infection of mice through eating the sputa in their food. The danger from such secondary causes, however, was slight compared with the original sewer danger.

(8) The children's epidemic was due to the same sewer emanations as the pneumonia of the adults, but its exact relation to that disease remains doubtful. Their symptoms closely resembled those of simple sewer air poisoning; and the evidence tends to show that their mild sickness was not infective.

(9) The disease was introduced from Scotter, first to Scotton, and then to Messingham. The manner of its introduction is unknown; but it is suggested that it occurred through winds carrying the poison given off from the south sewer to the surface nuisances and sewers of those places.

(10) The pneumonia which occurred in Scotter and its immediate neighbourhood during the prevalence of the influenza epidemic of 1891, was the same disease as that seen in the previous pneumonia epidemics. This is shown by its special incidence in the district where the pneumonic poison had become endemic, and especially by the marked selective power shown by the pneumonia in attacking houses, where, as a rule, influenza and insanitary conditions co-existed.

(11) The pneumonia seen in this neighbourhood is a preventible disease.

PREVENTIVE MEASURES.

It is now my task to try to show what preventive measures may be used in Scotter and neighbourhood in order to avoid a repetition of the terrible experiences of 1890, and if possible to eradicate the disease entirely.

The experience of Scotter with regard to the allied disease—Typhoid fever—is most encouraging, for it has all but disappeared; and there is reason to hope, if hearty good will be thrown into the efforts, that pneumonia may, in a few years, become equally rare.

Preventive measures will be dealt with under two heads:—

(1) Measures to be adopted in a sick house.
(2) Measures calculated to eradicate the disease from an infected neighbourhood.

PREVENTIVE MEASURES IN THE SICK HOUSE:—On the occurrence of a case of pneumonia in a house, the first efforts for prevention of other cases must be directed to discover and rectify the producing cause wherever it may be found. That done, there are certain dangers connected with the nursing and management of the patient. The poison of pneumonia is known to lie chiefly in the phlegm discharged from the lungs; whether other discharges contain it is not known. It is most important, therefore, to ensure the speedy destruction of this poison, and thus avoid risk of food and air becoming contaminated. For this purpose disinfectants are not available: it is uncertain whether those in ordinary use possess any effective power to destroy germs; at any rate it is certain that, as ordinarily used, they would have little or no beneficial effect, perhaps indeed would merely add piquancy to germ life. Some disinfectants it is true, readily kill this and other disease germs, but they are too dangerous for use by inexperienced hands. Fortunately simple and effectual means of destruction are found in fire and boiling water.

Great care and cleanliness, therefore, are needful in the disposal of the expectoration. Handkerchiefs are particularly dangerous, because they soon become dry, and the expectorated matters being given off into the atmosphere as dust, are liable to be inhaled by healthy persons. If handkerchiefs are used, there should be an old saucepan with water kept ready, into which they may be put when soiled, and thoroughly boiled, no handkerchief being used for more than a few hours. When the expectoration is profuse, and especially when bloodstained, it will be better to use rags or tissue paper instead of handkerchiefs :—these being burnt as used, all risk of food or air becoming contaminated is avoided. Soiled sheets, pillow cases, &c., should be placed in a copper of boiling water previously got ready; or if this is wanting they may be boiled in a large pan. If there is diarrhœa, the stools may be buried as in typhoid fever, and the vessels scalded by dipping in boiling water. Cups, spoons, and drinking vessels, should invariably be scalded after use. It is hardly necessary to say that all food rejected by the patient should be destroyed. Cleanliness on the part of the nurse is all-important; she should keep her nails cut short, and should never omit to wash her hands in hot water before taking food, which latter should never be done in the sick room. Expectoration which is received in a gallipot or other vessel, should be treated in the same way, the pot with its contents being placed in an old saucepan of such size that it can be entirely covered by water, and then boiled; this may be done from two to four times a day, and always before the vessel is half full. The chamber utensil should never be used to spit into.

Many pneumonic patients expectorate little or nothing, and perfect cleanliness is all that is required. In children, too, there is either no expectoration, or what little there may be is swallowed. The ordinary practice is for the mother to sleep in the same bed with her sick child, and the same practice is often followed by the nurse or some relative in the case of adults. This custom should be discontinued, for it is evidently attended with some risk on account of dried expectoration hanging about pillow cases, etc., which the utmost cleanliness cannot entirely obviate. Where the mother is the sole nurse of her sick child, she will, in most instances, best consult the child's safety by taking a few hours' rest in another bed in the same room. In adults the disease is so serious that the patients should be carefully attended to through the night; and the person who takes this duty should be alert, and therefore refreshed by sleep. The precautions of the sick room then resolve themselves into :—

(1) Perfect cleanliness.
(2) Destruction of sputa by boiling water.

Given these, the danger to nurses is far less than in cases of typhoid fever similarly conducted.

MEASURES CALCULATED TO ERADICATE THE DISEASE FROM AN INFECTED NEIGHBOURHOOD.—These may be considered in three sections :—

(*a*) The care of sewers and drains.
(*b*) The purification of surface soils in and around villages.
(*c*) The care of dwelling houses.

(*a*) The measures required to make the Scotter sewers and drains secure are not of a complicated nature. Some improvements were effected in June, 1890, and the rain-water inlets in the main street were secured by gully traps, and the house inlets on the east side of the sewer were also trapped. Since then new traps have been inserted as fresh pneumonic cases indicated their necessity. The latest cases of pneumonia show in a marked way the necessity for securing the remaining inlets, and for ventilation of the south sewer. Previous to April, 1890, that sewer was practically untrapped, aud sewer air escaped at many outlets ; but since then the most dangerous points have been secured, and this has gone on till perhaps only a fourth of the inlets are left insecure. That these latter are now a greater peril to those living near them than formerly is what one would expect, and this has been shown to be the case by the outbreak of pneumonia at such points. It is, therefore, urgently necessary to secure all inlets to the south sewer. That done, the sewer air and gasses would be pent up in the pipes, and pressure would soon become so great that the gas would force a way through the weakest traps, and danger at those points would be as great as ever. The measures needful, therefore, for securing the sewer are :—

(i.) Ventilation.
(ii.) Trapping of the remaining inlets.
(iii.) Provision for flushing in dry weather.

There appears to be a prejudice against ventilation. A little consideration will show how unreasonable such prejudice is: without ventilation the pent-up sewer air will still escape, but irregularly, fitfully, and at unknown points ; with ventilation it will escape at known points, and there only if the ventilation is efficient. Moreover, without ventilation, the germ-laden air escapes under the noses of the unsuspecting inhabitants. With ventilation, it escapes above their heads, and is rendered comparatively harmless by mixing with great volumes of air. In the one case the danger is always real, and in a dry time would soon become urgent ; in the other there is little or no danger, if the ventilators are judiciously placed.

One fact is worth notice: the outfall pipe of the south sewer directly faces north-east, and persons have remarked greater nuisance from the sewer during prevalence of north and east winds. It is interesting in this connection to remember that at one time the 1890 epidemic was ascribed to the prevalence of such winds; not of course to their action in pressing upon the column of air in the sewer pipes, and thus driving sewer air out at the higher inlets, but to direct action in causing bodily chill. There can be no doubt from the facts observed, and the good fall of the sewer, that there is at all times a strong up-draught from the outfall pipe to the higher parts of the sewer. Without ventilation this makes matters worse by more readily forcing the traps; but with good ventilators it will probably be an advantage, the outfall pipe being a large inlet for fresh air, the ventilators will be likely to act almost entirely as outlets. This being so, the wind would assist ventilation by clearing the sewer of noxious air, and render it harmless by dispersion. Ventilation, therefore, is absolutely necessary, if the sewer is to be even moderately safe, and its adoption is unusually easy for the reasons mentioned. Absence of noticeable smell is no argument against the necessity for ventilation, for it is certain that the pneumonic germs have no odour.

I need not further urge the necessity for trapping all inlets to the south sewer still insecure, the facts already narrated sufficiently emphasize this. It is a matter of doubt what kind of trap is best for ordinary yard use. Those most numerously inserted usually act well, but they need examination before putting down, as some are imperfect. A simple syphon gulley is perhaps the best form for village use. Whatever kind is used, there must be greater tendency to blocking up than under the old system of catchpits; and this must be guarded against by liberal use of water for flushing, and by care to secure as good a fall as possible. The old D traps are obviously unsafe for general use; they are always fitted loosely into a frame, and where there is any gas formed will allow it to escape between the trap and its frame. The only situations where they may be used with safety are at inlets to small private sewers, which are entirely under control, and kept thoroughly clean by frequent and forcible flushing; but instances in which efficient and systematic flushing can be relied upon are rare, and there can be no doubt that where yard drains run into the general sewer system, and where consequently foul air is sure to be present, loose D traps are insufficient and unsafe. Whatever the form of inlet—ordinary or syphon gully—it should rarely be placed near the house doors or windows; for in many instances the soil around becomes so sodden and foul as to be a source of danger. This danger should of course be avoided by emptying slops, etc., down the inlet, not throwing them at it as is usually done; and in laying gullies, the delivery pipe should not be simply fitted into the drain socket, but made water-tight with cement, and the top of the gulley surrounded by a sufficient paving of smooth non-absorbent bricks, such as Staffordshire bricks, the whole being so arranged that surface water will readily flow into it.

For flushing the main sewer in dry weather, a large water-cart should be provided by the parish, and placed in charge of the foreman of the roads. For full efficiency it is necessary that the outlet from the cart should be so large that the water can be emptied into the sewer very rapidly. The foreman should be instructed to use four or five water-cartfuls of water whenever there is prolonged dry weather, irrespective of the time of year. Two cartloads of water might be emptied into the main sewer at its highest point, that is, at the Scotton end, a street gully being put down there to enable this to be done; and other cartfuls should be emptied down the principal branches at their highest points. It is equally needful to provide some means of keeping the house drains clear, otherwise many of them will from time to time to time become blocked, and thus be a source of great danger, as I shall have occasion to show presently. The plan which I adopt on my own premises answers well. Its essential feature consists in the weekly or bi-weekly use of a thirty-gallon barrow. The amount of recent sediment which is thus washed out each time is astonishing. Unfortunately, this frequent flushing is impracticable for general use; safety must be sought, therefore, in the general safeguards already indicated, and their efficiency must be maintained by thorough flushing of the yard gullies and sewers at as frequent intervals as practicable. To this end, it will be necessary for the parish to provide one or two hand water-barrows, of thirty or forty gallons capacity, and place them in charge of the foreman of the roads, with instructions to lend them out to householders. The advantages of their use in preventing blocking of the yard drains would soon become so evident, that they would shortly be in general request. The cost of the barrows is small.

Similar precautions may with advantage be used for the small west sewers, but what is most imperatively required in them is attention to the trapping and cleanliness of the inlets. It is to the filthy condition of the inlets, as well as to the sewers themselves, that I am inclined to ascribe the pneumonia cases occurring in the western parts of the village.

At Messingham the main sewer has already been ventilated, but many untrapped inlets still exist. The outfall of the sewer running from the Horn Inn to a ditch just outside the village is a source of danger, being in the principal highway, within one or two feet of the most frequented footpath.

(b) The purification of surface soils in and around villages:—For the prevention of soil pollution and surface nuisances, two desiderata are to be kept in mind, viz:—dry yards and clean yards. Dry yards cannot be had unless the outbuildings are spouted, the spouts kept in working order, and the water conducted entirely away by sanitary pipes to the nearest ditch or sewer. If the rain-water is received into tubs, the overflow should be dealt with in the same way. Too often outbuildings are unspouted, or if spouted, the water is allowed to run into the yard or even into the crew-yard. If the water runs into the crew-yard much of the best part of the manure is washed away and wasted. No great danger perhaps results in a wet crew-yard, so long as it is well bedded; for straw, owing to its hollow stems, absorbs what liquid manure is not immediately washed away, and, bringing the liquid into contact with air throughout its mass, exercises a rapid and powerful oxidising effect. For this reason it is, I believe, that no harm commonly results from a wet crew-yard so long as it is full, but when the manure and straw are removed danger at once arises; not only will wells be polluted, but the foul pools of sewage in the yard present just the conditions necessary for growth of disease germs,—moisture, surface-dried islands of sewage, and perfect stagnation, with protection from winds, yet exposure to air. I have seen reason to believe that pneumonia has in some instances been thus caused. Crew-yards, when emptied, should never be left in this condition; sufficient straw should be led in to cover all wet patches. Failing straw, ditch dressings or even twitch grass are better than nothing. The best and most economical plan, however, is to have all buildings spouted and rain-water carried right away. It would then usually be unnecessary to have a sough running from the bottom of the fold-yard to carry away the most soluble portion of the manure. By the present system, rain-water is first conducted to the manure, and when it has dissolved the best parts, is conducted into a ditch, and so dispatched to the sea.

Clean yards around the houses cannot be had without attention to levelling; holes should be filled up and no sloppy pools allowed near house walls. Of still greater importance is it that slops and dirty water shall not be thrown haphazard anywhere near the house. Some people are very careful in this respect, always taking dirty water into the garden to trees, or throwing it on grass away from the house, or on dry manure. Where this is done, and from the position of the premises there is natural provision for rain-water to get away, I am strongly of opinion that no sewer is needed. I cannot remember a single case of pneumonia occurring in Scotter at a house without a sewer until the epidemic of 1890; and in the two cases then occurring, both were probably contracted away from the houses where they occurred. In the majority of cases, however, sewers are necessary evils; they prevent surface pollutions, especially if the inlets are kept clean; and in Scotter they have been of signal service in preventing filth being forced into the wells by heavy rains.

The care of privies is important:—No new privy should be constructed without an ashpit, which latter should be of small size, with sides and bottom cemented, and raised up, not sunk in the ground; a chimney-pot may be fixed in the roof to allow foul air to escape upwards. Many privies now existing have no ash-pit whatever, and are liable to become a nuisance. The only way to manage them is to empty them once a month; take care not to throw any liquid into the pit, but often put a shovelful of dry earth down, and dredge the bottom with quicklime after cleaning out. Privies with cesspits should invariably be ventilated, and kept as dry as possible. Some privies have ashpits entirely exposed to the rain; these are worse off than those without a pit, for they are emptied less often. There is no remedy for them short of putting a roof on; and as the bottom of the pit is never cemented the roof must be spouted, otherwise rain-water may soak through the wall into the pit.

Where the well and the privy are near each other, one must be moved; and the same with cesspools, or rather these latter should, if possible, be abolished entirely.

There are, therefore, two main factors in causing the epidemics of pneumonia; the first and most dangerous is the unguarded sewers, most to be dreaded in prolonged dry weather. The second is a polluted condition of the soil. All soils, but especially such as are sandy or gravelly, absorb much air, some of which is driven out when rain falls, particularly after heavy rains. The air thus expelled from polluted soils rises into the houses and yards, and, more or less diluted, is breathed by persons living under such conditions, giving rise to ill-health and especially to diarrhœa. Children are especially liable to suffer in this way, and I believe that some of the cases of pneumonia which I commonly see when heavy rains succeed a dry time, are due to such emanations existing around the houses and yards.

The remedy lies in a watchful care over the sewers and their inlets, and in the removal of all causes of surface pollution. The steps to be taken have already been indicated; but entire success cannot attend those measures unless constant care is exercised to *keep things right.* One of the latest cases of pneumonia shows the necessity for this admirably:—pneumonia had occurred in the house in 1887, and erysipelas under the same roof almost every year since. There was an untrapped opening into the sewer just between the two doors at about eight feet distance. Late in 1890, a gully trap was affixed, and the catchpit abolished; but, early in 1891, both sewer and gully were entirely choked with sediment, so that the people ceased using them and threw their slops elsewhere. In this choked condition the trap would be of no avail, for the disease germs could breed in the solid sewage of the gulley; hence, possibly, the explanation of the case of pueumonia just seen (September, 1891).

(*c*) The care of dwelling houses, &c.:—

Damp houses are very unhealthy, predisposing to many diseases; and there is no doubt the pneumonic germ is directly favoured by dampness in the walls and surrounding soil of houses. To rectify this the following points should be attended to:—The foundations should be dried by deep underdrainings, the pipes being large, and put in at least six feet deep, if fall can be obtained. Care should be taken that rain water cannot stand close to the walls, paving stones should incline away from them, or the walls should be packed with clean mud, hardened by a sprinkling of cement. Spouting should be kept well in order and well cleaned out; and it is absolutely necessary that the water should be properly disposed of; if there is a cistern it must have an overflow outlet; if paraffin casks are used, there must also be provision for taking overflow away from the house, otherwise the house might as well have no spouting. Where rain-water is stored in a cistern, it is needful to be sure that the water is really conducted into it, and does not soak into the soil under the house. Quite recently I have seen an instance in which soaking had been going on for a long time, making the house excessively damp. A portion of the rain-water may enter the cistern while the bulk saturates the walls around; this danger is easily overlooked.

After thorough under-drainage and efficient spouting of a house, the floors and walls, if still damp, may be dried by ventilation, by means of open doors and windows, assisted by fires. Extra windows put out on a damp side will help, but one of the most important points is to banish wall-paper, and that still more objectionable contrivance of laths and canvas; a contrivance which certainly causes a room to appear dry, but makes matters far worse for the unfortunate individuals who live in it, for it bottles up the moisture in the space between the walls and the canvas, and so doles it out imperceptibly; it is in fact a contrivance for the production of rheumatism, neuralgia, and a host of other complaints. Paper should be washed off all damp walls, and plain or coloured wash applied.

A word or two must be said about the school premises. Scotter is not alone in having had unhealthy outdoor conveniences for the children; both my father and myself have in past years attended much sickness traceable to this cause. The outdoor premises of many schools around have been much improved, but others are a continual source of danger, causing not only special illness, but exercising an insidious and pernicious influence on the childrens' health.

The remedy for this is evident: urinals and privies should not be allowed in close proximity to school walls and windows; and they should be properly constructed, and frequently cleaned. There are, however, serious difficulties in the way of carrying out such needful improvements at Scotter—the space is wanting.

Until this can be obtained, the present conveniencies should be perfected in structure, as far as possible, and cleansed very frequently.

Some readers, I am aware, will urge :—" Why all this fuss? Our fathers had nothing of the kind, and neighbouring villages are, and will continue to be, in the same condition as we have been—wholesome stench will hurt no one." *True!* but it must be remembered that we are in the presence of a formidable enemy of human life. However inefficient a soldier's weapons are in time of peace, when war comes he must look to them, or he will suffer. If our object were that of some savage peoples to get rid of old persons as useless members of society, the present condition of things would answer the end in view sufficiently well; but we do not look upon our fathers and mothers in such a debasing light: we want to keep them as long as we may.

This neighbourhood is naturally very healthy, and if this terrible disease with its sisters, epidemic diarrhœa, erysipelas, and diphtheria, were banished, there would be few parts of the country to surpass it in salubrity. To banish pneumonia and other similar diseases suddenly, is in the nature of things not possible; but if hearty goodwill be put into the efforts, they can almost entirely be got rid of in a few years.

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